Whether you think you can, or you can't - it's true.

Locus of control in status reproduction

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Zusammenfassung

Das Konzept der Kontrollüberzeugungen, auch "Locus of Control"(LoC) genannt, misst inwieweit Individuen ihre Lebensumstände durch sich selbst (Internalität) oder durch Faktoren, die außerhalb ihrer Kontrolle liegen (Externalität), begründet sehen. Zahlreiche Studien belegen einen statistisch signifikanten Zusammenhang zwischen der Ausprägung der Kontrollüberzeugungen und verschiedenen sozio-ökonomischen Statusindikatoren. Gleichzeitig scheint es einen Zusammenhang zwischen der sozialen Herkunft einer Person und deren Kontrollüberzeugungen zu geben: Personen mit höherem sozio-ökonomischen Status (SES) besitzen im Schnitt höher ausgeprägte internale Kontrollüberzeugungen als Personen niedrigerer sozio-ökonomischer Herkunft. Letztere tendieren eher zu externalen Attributionsmustern. Dies legt eine mediierende Rolle von Kontrollüberzeugungen in der intergenerationalen Transmission von sozialem Status nahe. Die vorliegende Dissertation erläutert die Mechanismen die diesem Transmissionskanal zugrunde liegen und überprüft die Relevanz des postulierten Transmissionskanals empirisch, um zu klären ob durch die Verringerung herkunftsbedingter Unterschiede in den Kontrollüberzeugungen ein höheres Maß an Chancengerechtigkeit erzielt werden kann. Um die Möglichkeit der Verringerung herkunftsbedingter Unterschiede in den Kontrollüberzeugungen abzuschätzen, wurde außerdem untersucht wie stark Kontrollüberzeugung genetisch determiniert sind beziehungsweise von sozialen Faktoren innerhalb und außerhalb des familiären Kontextes beeinflusst werden.

Aufbauend auf bestehenden Theorien wird argumentiert, dass sich Kontrollerfahrungen, aus denen Kontrollüberzeugungen entstehen, nach sozialem Status über die Lebensspanne hinweg unterscheiden. Kontrollüberzeugungen geben dabei die tatsächlichen Fähigkeiten einer Person ihre Lebensumstände zu beeinflussen relativ akkurat wieder. Diese Fähigkeit ist abhängig von der Gesamtmenge und Zusammensetzung der Ressourcen, zu denen eine Person Zugang hat. Kontrollüberzeugungen unterliegen jedoch auch psychologischen Verzerrungen, die der Aufrechterhaltung positiver Selbstbewertungen dienen. Durch diese Verzerrungen werden soziale Unterschiede in den Kontrollüberzeugungen verstärkt. Die so erworbenen Kontrollüberzeugungen wirken sich auf den eigenen erreichten Sozialstatus aus, in dem sie die erwarteten Erträge von individueller Bemühungen und Fleiß moderieren.

Die Relevanz von LoC für die intergenerationale Statusreproduktion wird mit Hilfe von Strukturgleichungsmodellen auf Basis der British Cohort Study 1970 untersucht. Die

Ergebnisse deuten darauf hin, dass LoC den Einfluss des Herkunftsstatus auf den eigenen Status teilweise mediiert. Kinder aus Familien mit höherem SES haben in der Tendenz einen stärker internalen LoC, welcher wiederum mit höherem Statuserwerb verknüpft ist. Die Größe des Mediationseffektes über LoC beträgt zwischen einem Drittel und der Hälfte des Mediationseffektes der durch kognitive Fähigkeiten vermittelt wird.

Inwieweit LoC genetisch determiniert oder auf soziale Einflussfaktoren zurückzuführen ist wird anhand klassischer und erweiterter Zwillingsmodelle untersucht. Die Analysen basieren auf einer multi-kohorten Panelstudie gleichgeschlechtlicher Zwillingspaare aus Deutschland (TwinLife). Die Ergebnisse zeigen änderungen des Einflusses von genetischen und Umweltfaktoren im Lebensverlauf: In der mittleren Kindheit erklären geteilte Umweltfaktoren etwa ein Viertel der Varianz in Externalität (ein Fünftel der Varianz in Internalität). Für junge Erwachsene ist der Erklärungsanteil geteilter Umwelteinflüsse nicht länger statistisch signifikant. Dafür erklärt im jungen Erwachsenenalter die genetische Ausstattung 16% der Varianz in Internalität und 17% der Varianz in Externalität. Die geringe genetische Determination des LoC lässt genug Raum für Interventionen innerhalb und außerhalb des Familienkontextes.

Das letzte empirische Kapitel untersucht den Effekt einer Intervention außerhalb des familiären Kontextes. Konkret wurde untersucht wie sich die Verfügbarkeit eines Mentors im mittleren Kindesalter auf die Entwicklung von Kontrollüberzeugungen auswirkt. Dazu wurden Daten einer randomisiert-kontrollierten Interventionsstudie (briq Family Panel) analysiert. Im Rahmen der Studie wurden 212 Kinder im Alter von 7-9 für etwa ein Jahr einmal wöchentlich von ihren Mentoren begleitet. Die kausal interpretierbaren Ergebnisse deuten nicht auf eine statistisch signifikante änderung in den Kontrollüberzeugungen durch die Intervention hin. Bei genauerer Betrachtung wird jedoch sichtbar, dass die Kinder in der Mentoring Gruppe selbst sechs Jahre nach der Intervention noch signifikant weniger davon überzeugt waren, dass ihr Leben von Schicksal und Glück bestimmt sei.

In der Diskussion wird neben einer Zusammenschau der Ergebnisse auch die gesellschaftliche Norm zur Internalität kritisch betrachtet. Sowohl internale als auch externale Kontrollüberzeugungen können adaptiv sein, sofern sie auf realistischen Einschätzungen der tatsächlich vorhandenen Kontrollmöglichkeiten basieren. Die Grenzen der tatsächlich vorhanden Kontrollmöglichkeiten zu erforschen und zu benennen wird als wichtiges Ziel soziologischer Forschung in diesem Bereich herausgestellt.

Summary

Locus of Control (LoC) captures the degree to which individuals accept personal responsibility for what happens to them, in contrast to attributing this responsibility to forces outside their control. LoC has been repeatedly and robustly connected to a variety of status-relevant outcomes. At the same time LoC is not distributed equally: Individuals with a higher socio-economic status (SES) are more likely to have internal LoC beliefs while low-SES individuals are less likely to hold these empowering LoC beliefs. This suggests that LoC might play a role in the intergenerational transmission of social status. This dissertation set out to assess *the role of LoC in the intergenerational transmission of social status, and the potential to raise fair equality of opportunity through reducing the social gradient in LoC.* The*first research aim* was to *explicate the mechanisms through which social status is reproduced via LoC across generations theoretically.* The *second research aim* was to *test the substantive relevance* of LoC in the transmission of social status empirically. If the contribution of LoC were substantive, it might provide a lever to reduce the intergenerational persistence in social status and enhance fair equality of opportunity. As the potency of this lever depends on the degree to which LoC is socially formed rather than genetically determined the *third research aim* was to provide evidence on the *contribution of genetic inheritance and different social actors at different points in the life-span.*

Building on existing theories it is argued that experiences of control, which form the basis of LoC differ by social status across the life-span. LoC is hypothesized to be a relatively accurate reflection of a person's actual ability to affect their environment. This ability is a function of the total amount and composition of the resources to which a person has access. Subjective assessments of this ability are, however, subject to psychological biases that allow maintaining positive evaluations of the self. Moreover parental social status is assumed to influence children's LoC by altering children's own experiences and by affecting the content of what children learn through vicarious experiences and persuasion. LoC in turn affects status-relevant outcomes by altering expected return to effort.

Structural equation modeling is used to assess the substantive importance of LoC in the intergenerational reproduction of social status. The analyses are conducted based on a representative study of U.K. children born in 1970 surveyed until today (British Cohort Study 1970). The evidence suggests that LoC partly mediates the influence of parents'

status on own status attainment: Children from low-SES households are less likely to be endowed with the type of LoC that benefits status attainment later in life. LoC transmits roughly one-half to one-third of the share of the association that is transmitted via cognitive skills. Hence LoC is a potential lever for reducing intergenerational status persistence.

The extent to which LoC is genetically determined and to what extent social factors determine it is assessed by a classic and an extended family twin model using data from a multi-cohort panel of German same-sex twins (TwinLife). The results indicate that the contribution of genetic and environmental factors differs between mid-childhood and young adulthood. In mid childhood shared environmental factors explain roughly one fourth of the variation in externality and one fifth of the variation in internality. The rest is explained by non-shared-environmental factors. For young adults, shared environmental effects no longer explain a significant part of the observed variation in LoC. Non-shared environment explained about 80% of the observed variation in internal and external LoC in young-adulthood. Genes explained 16% of the variation in internality, and 17% of the variation in externality. This means that there is some leeway to manipulate LoC orientations by intervention, within and outside of the family context.

Data from a randomized controlled intervention study that paired 212 low SES children with a personal mentor for one year are analyzed to identify the causal influence of a formalized low-intensity mentoring program on the formation of LoC in mid-childhood. Mentoring was not found to alter low-SES children's general LoC in a statistically significant way. Mentored children were, however, significantly less fatalistic even six years after the intervention. Considering that externalism drives the social-divide in LoC this result is little surprising.

The synposis of these results suggests that policymakers and practitioners should focus on external LoC and fatalism in particular. Firstly, because this dimension of LoC seems to drive the social gradient in LoC, and secondly, because targeting external LoC seems to be more cost-efficient. The discussion also reflects upon a general social norm of internality. It is argued that internality and externality are functional if they are based on a realistic assessment of the boundaries of control. Providing empirical evidence for these boundaries is endorsed as an important goal for social scientific research.

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List of Abbreviations

ANOVA Analysis of variance

ASOC Study of Aging, Status, and the Sense of Control

ALSPAC Avon Longitudinal Study of Parents and Children

BCS70 British Cohort Study 1970

BFP briq Family Panel

CFI Comparatory Fit Index

DWLS Diagonally Weighted Least Squares

FIML Full Information Maximum Likelihood

GWAS Genome Wide Association Study

GPA Grade Point Average

GNI Gross National Income

HILDA Household, Income and Labour Dynamics in Australia

IPW Inverse Probability Weights

ITT Intention to Treat

KMK Standing Conference of the Ministers of Education and Cultural Affairs

LMS Latent Moderated Structure

LSYPE Longitudinal Study of Young People in England

NEET Not in Employment and Education

NELS	National Education Longitudinal Study
NLS	National Longitudinal Survey of Labour Market Experiences
NLSY	National Longitudinal Study of Youth
NS-SEC	National Statistics socioeconomic Classification
OECD	Organisation for Economic Co-operation and Development
QTL	Quantatitative Trait Loci
RMSEA	Root Mean Squared Error of Approximation
SD	Standard Deviation
SEM	Structural Equation Modeling
SEB	Socio-Economic Background
SES	Socio-Economic Status
SSES	Study on Social and Emotional Skills
SOEP	Socio-economic Panel Study
SOEP-IS	Socio-economic Panel Study - Innovation Sample
SNPs	Single Nucleotide Polymorphism
TLI	Tucker-Lewis Index
U.K.	United Kingdom
U.S.	United States
UN	United Nations
UPI	Unconstrained Product Indicator

Chapter 1

Introduction

"Whether you think you can, or you think you can't–you're right."
(Henry Ford)

1.1 Motivation

In most western industrialized countries, individuals' social status is associated with the social status of their parents (Breen and Müller, 2020; OECD, 2018). This phenomenon is referred to as social reproduction, status reproduction, intergenerational status-persistence, or intergenerational status transmission. According to a simulation study by the Organisation for Economic Co-operation and Development (OECD), on average, it would take roughly four-and-a-half generations, or 150 years, until the offspring of a family in the lowest OECD income decile reached the average OECD income level.[1]

Privileges that are based on inherited social status are, however, considered unjust by an overwhelming majority of the population of these countries (Adriaans et al., 2020). Eighty percent of the European population support the view that a society is just when hard-working individuals earn more than others (Adriaans et al., 2020). This indicates that the majority's justice considerations are in line with the meritocratic ideal. The meritocratic ideal requires that rewards and remuneration gained by individuals are proportional to their individual effort. This principle is a central pillar to the industrialized worlds' ed-

[1]The OECD precautions that these figures are simulation-based and for illustrative means (OECD, 2018). The simulation is based on current income elasticities for fathers and sons and current levels of inequality.

ifice of social justice.[2] Equality of opportunity is a pre-requisite for meritocracy. Equality of opportunity requires that individuals have equal access to advantage, regardless of their social origins, their gender, ethnic background, and other characteristics they cannot be held responsible for (Arneson, 2015; Cohen, 1989).[3] The only thing that should count is their effort. Total equality of opportunity is a utopic ideal. Therefore, most western industrialized societies adopted the principle of '*fair equality of opportunity*' into their political agendas. Anti-discrimination legislation and the extension of free-of-charge state-funded educational institutions attest to this effort. One important indicator for the degree to which opportunities are fairly distributed is social mobility. Social mobility measures the fraction of individuals that attain a different social status than their parents.[4] Status reproduction, in contrast, indicates for the absence of fair equality of opportunity.

The last decades have brought significant increases in social mobility. Educational expansion, often coupled with educational equalization[5], have been a driving force behind the observed reductions in social reproduction in many countries (Breen, 2010; Breen et al., 2009; Pollak and Müller, 2020). However, a respectable body of empirical evidence suggests, that the upsurge of social fluidity has slowed down, and even come to a halt in some countries (Breen and Müller, 2020; Chetty et al., 2014; Markussen and Røed, 2020; OECD, 2018).There seems to be a base-level of status persistence that operates independent of the formal education system and is relatively stable (Pollak and Müller, 2020).[6]

Why does social reproduction persist despite formal equality of opportunity, continued educational expansion and equalization, and policy-backed efforts to provide equal chances for all? Sociological research suggests that access to particular types of social- (Granovetter, 1973) and non-institutionalized cultural capital but also habitual ways of perceiving the world and reacting to it (Bourdieu, 1984) and a number of social-psychological factors

[2]Another central pillar is the needs-principle, which holds that a person's basic needs ought to be fulfilled.

[3]In a world where equality of opportunity is perfectly fulfilled, the privileges enjoyed by a person should be completely uncorrelated with their status of origin, gender, ethnic background, or their attractiveness.

[4]Typically, absolute and relative social mobility are distinguished, but for the present purspose the distinction is not essential.

[5]Educational equalization occurs if educational attainment becomes less dependent on parental social status.

[6]A recent study by Pollak and Müller (2020) indicates that almost all of the observed reduction in intergenerational status persistence in Germany was due to changes in the educational sector. Roughly one-third of the association between parents' and children's social status is direct and relatively stable across cohorts.

might contribute to the intergenerational persistence of social status (Haller and Portes, 1973; Hauser, 1972; Sewell, 1961). This dissertation is concerned with the latter.

"Common sense suggests that personality traits, persistence, motivation and charm matter for success in life."
(Heckman, 2006, p. 412)

Socio-emotional skills seem to have an impact on life-chances that is comparable to that of cognitive skills or social background (Roberts et al., 2007). Within the literature that confirms the importance of socio-emotional skills in determining life-chances, locus of control (also referred to as perceived control) sticks out as having a particularly robust positive effect on an extraordinary variety of outcomes. Outcomes that have been shown to be significantly associated with locus of control range from educational choice and attainment (Aspelmeier et al., 2012; Baron and Cobb-Clark, 2010; Wang et al., 1999), to labor market participation, job search behavior, length of unemployment spells (Berger and Haywood, 2016; Caliendo et al., 2015; McGee, 2015) to income, wages, and occupational status (Groves, 2005; Heineck and Anger, 2010; Schnitzlein, 2016). Locus of control has also been associated with other individual outcomes that bear societal relevance, such as mental and physical health (Almlund et al., 2011a; April et al., 2012; Infurna et al., 2011; Mirowsky and Ross, 1990b; Weisz and Stipek, 1982), delinquency, environmental behavior, and political participation (Almlund et al., 2011b; Engqvist Jonsson and Nilsson, 2014; Heckman et al., 2006; Levenson, 1974; Nowicki and Segal, 1974).

The concept of locus of control is attributed to Julian B. Rotter (1966). It captures the degree to which individuals "accept personal responsibility for what happens to them, in contrast to the attribution of responsibility to forces outside their control" (Battle and Rotter, 1963, p. 482). "It is one of the most robust influences on whether individuals and groups will take initiative, exert effort, and persist, especially in the face of challenges and obstacles (Weiner, 2010); it is an essential moderator of the effects of stressful experiences, and how people deal with and rebound from hardship (e.g., Folkman, 1984) (...) In every suite of measures designed to identify social and psychological factors that foretell well-being, thriving, and resilience, research repeatedly accords perceived control a central place among the top predictors" (Skinner, 2017, p.310).

Locus of control is, however, not distributed equally across social status groups. Empirical evidence based on small and large-scale nationally representative samples of children suggests that there is a social divide in perceived control, which manifests at a very early age (Stephens and Delys, 1973), stabilizes in childhood (Bartel, 1971; Battle and Rotter, 1963; Elkins and Schurer, 2020; Flouri, 2006), and persists into adulthood (Elkins and Schurer, 2020; Golding et al., 2017; Lewis et al., 1999). Individuals from higher socio-economic strata are more likely to have locus of control beliefs that have been connected to high-status attainment and other desirable outcomes. Individuals from low-status families, in contrast, are less likely to hold these empowering locus of control beliefs. Often low-status background is even connected to a greater probability of holding locus of control beliefs that undermine efforts.

The synopsis of these strands of locus of control research inevitably suggests that locus of control might play a role in the intergenerational transmission of social status. However, the strands of research laid out above have hitherto remained unconnected. One part of the literature treats locus of control as a dependent variable, explaining how differences in locus of control come about, without paying too much attention to its consequences. Another part of the literature treats locus of control as an independent variable, predicting all sorts of desirable outcomes, as if they existed in a social (and biological) vacuum. This dissertation integrates these strands of research from a sociological perspective focusing on inequality-generating mechanisms. It adds some social-atmosphere by arguing that a person's position within society is a central determinant of their locus of control beliefs.

1.2 Methodology, research aims and central results

Methodologically this dissertation is inspired by Bronfenbrenner's (1995) ecological model of human development, which stresses the importance of considering individual development in the context of multiple layered social spheres. In line with Parsons (1977, p. 7) encouragement that "any good sociologist would (...) consider the relation between personality and social structure in the perspective to the life cycle, as necessarily including a series of stages of socialization" a life-course perspective is adopted whenever possible (Elder, 1985; Elder and Rockwell, 1979).

The *overarching topic* of this dissertation is *the role of locus of control in the intergenerational transmission of social status, and the potential to raise fair equality of opportunity through reducing the social gradient in locus of control.* For lack of a theoretical account that explicates the mechanisms through which social status affects locus of control, and through which locus of control affects status attainment in turn, the *first research aim* was to *explicate these mechanisms.* The existence of a theoretical pathway does, however, not say much about its substantive relevance. Therefore, the *second research aim* was to *test the substantive relevance* of locus of control in the transmission of social status empirically. If the contribution of locus of control were substantive, it might provide a lever to reduce the intergenerational persistence in social status and enhance fair equality of opportunity. The potency of this lever depends on the degree to which locus of control is socially formed rather than genetically determined. Detailed knowledge on the influence of different types of social actors (family, peers, institutions) at different points in the life-span is required to design cost-efficient yet effective programs that aim to reduce social class differences in locus of control. The *third research aim* was therefore to provide evidence on the *contribution of genetic inheritance and different social actors at different points in the life-span.*

Central Research Questions

1. How (i.e., through which mechanisms) might locus of control contribute to the intergenerational reproduction of social status?
2. How large is the contribution of locus of control to the intergenerational reproduction of social status?
3. What is the contribution of genetic and different types of social factors to the formation of locus of control, across the life-course?

For all three questions, relevant existing theories and empirical evidence have been assembled in this thesis and complemented by novel theoretical reflections and empirical investigations.

The *first question* on mechanisms through which locus of control may contribute to the intergenerational reproduction of social status was addressed *purely theoretically.* Building upon existing theories and empirical evidence, the Theory Chapter traces all the relevant steps from how parental social status affects parents' and children's locus of control and how children's locus of control affects their own status attainments in turn. It is argued that adults' locus of control orientations are a relatively accurate reflection of their actual abilities to affect their environments. A person's actual ability to affect their outcome is a function of the total amount and composition of the resources to which they have access. Moreover, locus of control is argued to be a *relatively* accurate reflection of actual control because it is subject to several psychological and cognitive biases that allow its holder to maintain or improve positive self-evaluations. Parental social status is assumed to influence children's locus of control by altering children's own experiences and by affecting the content of what children learn through vicarious experiences and persuasion. Children's experiences of control, from which locus of control is formed, are hypothesized to differ by parental social status for cultural reasons but also because parental interactions with the children and the type of experiences they can offer the children are determined by the resources that are available in the parental household.

In the tradition of the Blau et al. (1967) and the Wisconsin Social-Psychological Model of status attainment (Haller and Portes, 1973; Sewell et al., 1969) a path-analytical approach is used to address the *second question* concerning the substantive importance of locus of control in the reproduction of social status. Structural Equation Modeling (SEM) is used to assess the degree to which the influence of a person's Socio-Economic Background (SEB) on their own status is mediated via locus of control (mediator hypothesis). To identify mechanisms of cumulative advantage, it is also tested whether the influence of locus of control on Socio-Economic Status (SES) differs by parental social status (moderator hypothesis). The empirical analyses are conducted based on a representative cohort panel study of U.K. children born in 1970 surveyed until today. This data-set was chosen because it provides rich prospective information on the social status of the families in which the children grew up together with an early measure of locus of control (taken prospectively at the age of ten) and prospectively measured indicators of status attainment in mid-adulthood when status attainment has peaked. Early measurement of locus of control is central in order to isolate the effect of SEB on locus of control. Regarding the mediation hypothesis, the evidence suggests that locus of control partly mediates the influence of parents' status on own status attainment. Children from low-SES households are less likely to be endowed with the type of locus of control that is beneficial for educational and occupational attainment later in life. Concerning the substantive importance of this transmission channel, locus of control is found to transmit roughly one-half to one-third of the share of the association that is transmitted via cognitive skills. Considering the amount of attention that is given to cognitive skills, it is surprising that locus of control has remained under the radar of practitioners and policymakers for so long. Regarding the moderation hypothesis, the evidence suggests that the beneficial effects of locus of control do not differ by parental social status. These results imply that locus of control is a potential lever for reducing intergenerational status persistence - *iff* it were susceptible to intervention.

The *third question*, regarding the contribution of genetic and environmental factors to the construction of locus of control across the life-span, was addressed in two different empirical investigations. The extent to which locus of control is genetically determined and to what extent social factors determine it is assessed by a classic and an extended family twin model using novel data from a multi-cohort panel of German same-sex twins. The multi-cohort design allows assessing changes in the contribution of genetic and social factors to locus of control across the life-span. The results indicate that the contribution of genetic and environmental factors differs considerably between mid-childhood and young adulthood. In mid childhood, variation in locus of control is entirely socially determined. Shared environmental factors explain roughly one fourth of the variation in externality and one fifth of the variation in internality. The rest is explained by shared-environmental factors. For young adults, shared environmental effects no longer explained a significant part of the observed variation internality and externality. The impact of the non-shared environment increased in young adulthood and explained about 80% of the observed variation in internal and external control beliefs. Additive genetic factors explained 16% of the variation in internality, and 17% of the variation in externality. Non-additive genetic effects were not found. In sum, the evidence suggests that there is some leeway to manipulate locus of control orientations by means of intervention, within and outside of the family context. The last empirical chapter takes a closer look at the influence of extra-familial social influences on locus of control. Data from a randomized controlled intervention study that paired 212 children from low-status households with a personal mentor for one year are analyzed to identify the causal influence of a formalized low-intensity mentoring program on the formation of locus of control in mid-childhood. It also investigates which children benefit most from the mentoring program and whether a mentor can make-up for the children's low-SES in terms of their locus of control development. The mentoring intervention was not found to alter low-status children's general locus of control in a statistically significant way. When different dimensions of locus of control were considered, mentored children were found to be significantly less fatalistic even six years later. This means that they felt less determined by luck and fate than their peers who were not mentored. The evidence indicates that luck-and-fate externalism is the dimension of locus of control that drives the social-divide in locus of control. The results are in line with other intervention studies targeting locus of control that also found that the intervention programs mainly affected the external dimension of locus of control.

The discussion illustrates how locus of control is affected by different social spheres ranging from a person's proximal environment to the general ideologies of our time. It argues that processes of modernization impinge upon the culturally accepted locus of control orientation. Natural domestication, structural differentiation, individualization and rationalization not only foster internality but force it upon the individual. Internality is socially accepted and endorsed while externality are frowned upon and repressed. This social norm is critically reflected. It is argued, that internality is not always better. Both internality and externality may be functional if they are based on a realistic assessment of the boundaries of control. On a societal level, it is relevant to communicate that these boundaries of control may be different from different individuals. Providing empirical evidence for these boundaries is endorsed as an important goal for social sciences. As far as status reproduction is concerned, the discussion argues that policymakers and practitioners should focus on external locus of control and fatalism in particular. Firstly, because this is the dimension of locus of control that drives the social gradient in locus of control beliefs, and secondly, because targeting external control beliefs is more cost-efficient.

1.3 Relevance and contribution

This dissertation set out to assess the current locus of control literature from a sociological perspective, focusing on how existing inequalities obstruct equal access to advantage. Such a perspective had been mostly missing in recent locus of control publications where locus of control is used as a predictor for various outcomes. To the extent that fair equality of opportunity is a relevant normative goal, a better understanding of any mechanisms that may obstruct it, their substantive relevance, and potential methods for enhancing fair equality of opportunity becomes *practically* important. This implies that reliable empirical evidence on the degree to which the unjust dependence of a person's social status on their parents' social status is due to locus of control, and the degree to which locus of control is genetically versus socially determined is needed. An excellent understanding of how locus of control is affected by different social actors at different points in the life-course is essential to devise policies that reduce the social gradient in children's locus of control in a cost-efficient way. This dissertation provides relevant empirical evidence towards this goal.

On a *theoretical* level, this thesis' major contribution is the development of a theoretical account of the role of locus of control in the process of social reproduction. The formulation of this account entailed two additional theoretical contributions: Firstly, a theoretically derived argument in favor of treating internal and external locus of control as separate dimensions rather than as two ends of a single dimension is presented. Secondly, it suggests that psychological adjustments to locus of control may serve to maintain a positive evaluative assessment of the self, even if no positive effects on affective well-being are observed. Both arguments still need to be tested against the data, however.

The analyses presented herein for the first time investigated the role of locus of control in the intergenerational transmission of social status in a single empirical framework. These analyses provide a first hint at the substantive relevance of locus of control in the transmission of social status. The analyses also contribute to an ongoing debate on the relative importance of cognitive and non-cognitive skills in the status attainment process by comparing the mediation effect of locus of control to that of cognitive skills. By considering more complex relationships between socioeconomic background and locus of control in the status attainment process, the analysis in Chapter 6 also contributes to the sociological literature concerned with cumulative advantage.

So far, there is only a handful of behavior-genetic studies on locus of control. These studies' results vary significantly by the measure of locus of control, the dimensions, the age of the population under study, and the type of informant. The analyses on the heritability of locus of control contribute towards this literature not only by presenting evidence for the classical twin design based on a novel data-set, but also by providing the first behavior-genetic analysis of locus of control that is based on an extended family design. This, for the first time, allowed a joint estimation of dominant and additive genetic effects as well as twin-specific environmental effects and vertical cultural (i.e., non-genetic) transmission from parents to children.

The assessment of the causal effects of a specific mentoring program on locus of control in low-status children contributes to the scant literature on extra-familial determinants of locus control. Focusing on a particular age group, the study contributes to the literature on sensitive and critical periods in the development of locus of control, thereby contributes to the literature on skill-development (Cunha and Heckman, 2007). By explicitly investigating the effect of the intervention on the impact of background variables, this study goes beyond many evaluations of intervention programs, which typically assume independent effects from background variables and the treatment (Heckman et al., 2013).

Worldwide initiatives to expand educational policies to include the domain of socio-emotional skills (Kankaraš and Suarez-Alvarez, 2019; OECD, 2015) underscore the relevance of this research. In 2015 the OECD reported that the development of socio-emotional skills has been adopted into the national educational objectives and curriculum frameworks by almost all member countries.[7] A later OECD report highlighted however that the conditions under which these skills prosper are far from clear. Therefore, the OECD initiated a new study program in 2017 that aims to "provide policymakers, education practitioners, parents and researchers a more comprehensive knowledge-base on where and how to improve systems, policies and practices in order to better support students' social and emotional skills development" (Kankaraš and Suarez-Alvarez, 2019, p. 13). The Study on Social and Emotional Skills (SSES) focuses on children aged ten and fifteen from ten cities around the world and covers a comprehensive set of contextual factors including information from parents, schools, and peers to identify the contextual factors that promote or

[7]The degree of institutionalization varies however across countries. In some countries, socio-emotional skills are supposed to be fostered as by-products of other educational activities, such as group work or physical education. In other countries, such as Israel or the U.K. basic knowledge on socio-emotional skills is taught in dedicated subjects. Israel, for example, introduced a subject called "Life-Skill Studies" in 1997, which aims to develop pupils social and emotional strength and cope with difficult situations (OECD, 2015). It focuses on self-identity, self-regulation, interpersonal relations, leisure, career-choice, learning, and coping with stress. In the U.K. a non-statutory subject is offered in lower-secondary schools which aims to help pupils develop their personal identities, confidence, self-esteem, understand what influences their decision-making, and educates on the dangers of alcohol and drug abuse (OECD, 2015).

hinder skill development (Kankaraš and Suarez-Alvarez, 2019).[8] The study covers a set of seventeen skills that were selected based on previous research. While locus of control is not directly part of this set of skills, self-efficacy, a concept closely related to locus of control, is part of the study. The empirical analyses in this dissertation contribute towards closing this gap in the knowledge of the importance of contextual factors in the determination of socio-emotional skills, focusing on an important exemplar of these skills, locus of control.

1.4 Structure and content of the thesis

Chapter 2 briefly outlines the analytical approaches by which this thesis is inspired. It is inspired by the *Social Mechanisms* approach which demands that social sciences not only describe social phenomena, but explain them by uncovering their generative mechanisms. A broader analytical framework is provided Urie Bronfenbrenner's (1995) socio-ecological model of development, which illustrates how different social spheres may affect individual development. Bronfenbrenner's static model is complemented by Glen Elder's (1994) life-course theory to integrate a more inter-temporal perspective.

Chapter 3 introduces the central concept of this thesis: *Locus of control*. A definition of the term is provided together with a short description of its origination from social-learning theory. The origination in social learning theory will be used for theory-development in the fifth Chapter. The unsettled debate on the dimensionality of locus of control is presented, and some measurement instruments that are frequently encountered in the literature are introduced. Evidence on mean-level changes in locus of control across time is discussed together with macro-level societal changes that may have been the driving forces behind such changes. Mean-level changes and rank-order consistency across the life-span are discussed thereafter. Normative developmental changes in locus of control should be known to interpret existing research findings correctly. Gender differences in mean-levels of locus of control across the life-span are also discussed. Another part of Chapter 3 is dedicated to a small number of concepts that are very closely related to locus of control, such as Bandura's (1977b) self-efficacy, learned helplessness, and explanatory style. The last part of Chapter 3 builds on the previous sections and discusses whether locus of control should be considered a trait, and thus relatively stable, or a skill and therefore open to change.

[8] The study started in mid-2017, and results from the first round are expected in 2021.

Chapter 4 provides a review of the two strands of locus of control literature that inspired this thesis. The first part reviews the empirical evidence on the association between locus of control and central determinants or social status indicators, including educational and occupational attainment. Besides these classical status indicators, the chapter also briefly reviews the evidence on the association between locus of control and further relevant dimensions of inequality, including physical and mental health, delinquency, and political participation. The second part reviews the empirical evidence on the association between a person's socioeconomic background (i.e., the social status of the family the person grew up in) and their locus of control orientation. The synopsis of these two strands of empirical literature suggests that locus of control is both a structured structure and a structuring structure in the sense of Bourdieu's (1984) and might thus contribute to status reproduction. To the extent that locus of control contributes to status reproduction, it should also be of interest to sociologists.

Chapter 5 draws upon various theoretical accounts and previous findings from empirical research to explicate the process through which locus of control may contribute to the process of social reproduction. It starts by laying out the function of locus of control in predicting behavior in general, thereby explaining why locus of control is associated with so many relevant life outcomes. The remainder of the chapter explicates how social status may affect locus of control convictions over the life-course. It starts at adult age to show how locus of control convictions within one generation are affected by their own social status. The chapter continues by assessing how the family's social status may affect children's locus of control orientations through different sources of learning. Cultural and resource-based theories are drawn upon to explain how parents' social status may affect the experiences on the basis of which children's locus of control is formed. The final section points out how the consequences of initial social class differences in locus of control may be exacerbated if a) the returns to locus of control depend on other types of resources or b) returns to locus of control accumulate over time.

Chapter 6 contains the empirical analyses investigating the substantive relevance of locus of control in the reproduction of social inequality (mediation analysis) and potential interactions between social background and locus of control in the status attainment process (moderation analysis). It starts by clarifying the motivation driving these analyses, the chapter's research aims, and the relevance to the literature. In the second part, hypotheses are developed building on the theoretical reflections laid out in Chapter 5 and additional theoretical accounts concerned with cumulative advantage. The third part reviews evidence from related research. The method, SEM, is introduced and justified in the fourth section. The data-set used for this chapter, the British Cohort Study 1970 (BCS70) is introduced, and the operationalization of core concepts and handling panel attrition are discussed. The results section presents some descriptive results before discussing the evidence on the SEM models separately for the mediation and the moderation analyses. The results are discussed in the light of the results of related research and the limitations of the analyses. After giving recommendations for further research and discussing the results' policy implications, the chapter closes by summarizing the results.

Chapter 7 is dedicated to identifying the contribution of genetic and social factors to the formation of locus of control. The motivation and relevance of doing so are clarified in the first section, and central research aims are clarified. Theoretical and methodological foundations of behavior-genetic research are introduced before specific hypotheses are formulated. After that, already existing evidence on the genetic and social determination of locus of control is discussed. The methods section briefly explains the classical and the extended family twin model. The TwinLife study is introduced, the operationalization of central concepts is presented, and differences between the representative initial sample and the sample used for the analysis are discussed. The results section presents the results for the classic and the extended twin design. All results are discussed and compared to the existing body of evidence. Practical implications of the results are discussed before the chapter closes with a brief summary.

Chapter 8 uses data from the briq Family Panel to assess the causal effects of a low-intensity mentoring program on locus of control of low-SES children. As in previous chapters, motivation and research aims are stated before hypotheses are developed based on existing theories from resilience research. Afterward, existing evidence on the ability to alter locus of control through planned intervention is reviewed. The intervention and the briq Family Panel are introduced, and the operationalization of key constructs is discussed. The results section starts by testing the validity of an auxiliary hypothesis on mentors' locus of control. The effects of the intervention of overall locus of control and its components are discussed before moving on to differential treatment effects and mentors' potential to compensate for the children's low social status in terms of locus of control development. The results are discussed in the light of prior research and the limitations of the study, and recommendations for further research are made. The conclusion summarizes and provides recommendations for policymakers.

Chapter 9 summarizes the theoretical and empirical contributions of this dissertation and discusses them in a broader sociological context. The latter is achieved by making explicit how locus of control is affected by different social spheres. Theoretical and practical implications of the dissertation are discussed. This includes also a critical reflection of the common assumption that more internality is always better. Suggestions for policymakers are made as well as suggestions for further research.

Chapter 2

Analytical approach

Scrutinizing the phenomenon of locus of control from a sociological perspective that is concerned with inequality generating mechanisms, this thesis takes an eclectic analytical approach that combines a social mechanisms approach with an analytical framework provided by Urie Bronfenbrenner's socio-ecological model of human development and Glen Elder's life-course theory.

2.1 Analytical Approach: Social Mechanisms

The social mechanisms approach, was developed after the second World War, and is typically accredited to a group of authors including (bot not restricted to) Merton, Schelling, Boudon, Ester, Coleman and Little (Tranow et al., 2016). The central premise of the mechanisms approach is that social sciences should not only aim to describe social phenomena, but to explain them. To explain a phenomenon means to spell out its generative process. "A satisfactory explanation demands explication of the sequences and steps through which X and Y are causally linked - i.e. why and how X leads to Y" (Tranow et al., 2016, p. 5). It is rooted in structural individualism and hence requires an action-theory as a micro-foundation. The weak version of structural individualism that is often found in sociology assumes that while structures are a crucial part of of the explanation of social phenomena, structures have no power in and off themselves, but instead exert their power through the actions of individuals (Udehn, 2002). The micro-foundation that is assumed in this dissertation rational action theory (Goldthorpe, 1998).

Inspired by the social mechanisms approach this dissertation will aim to trace all the mechanisms through which social-stratification affects individuals locus of control, and through which individuals locus of control will then affect their own position in the social structure. To be able to explicate all these mechanisms, it is necessary to consider the the individual's embeddedness into particular social-and historical context.

2.2 Analytical framework: Ecological model of development and life-course theory

2.2.1 Bronfenbrenner's socio-ecological model of human development

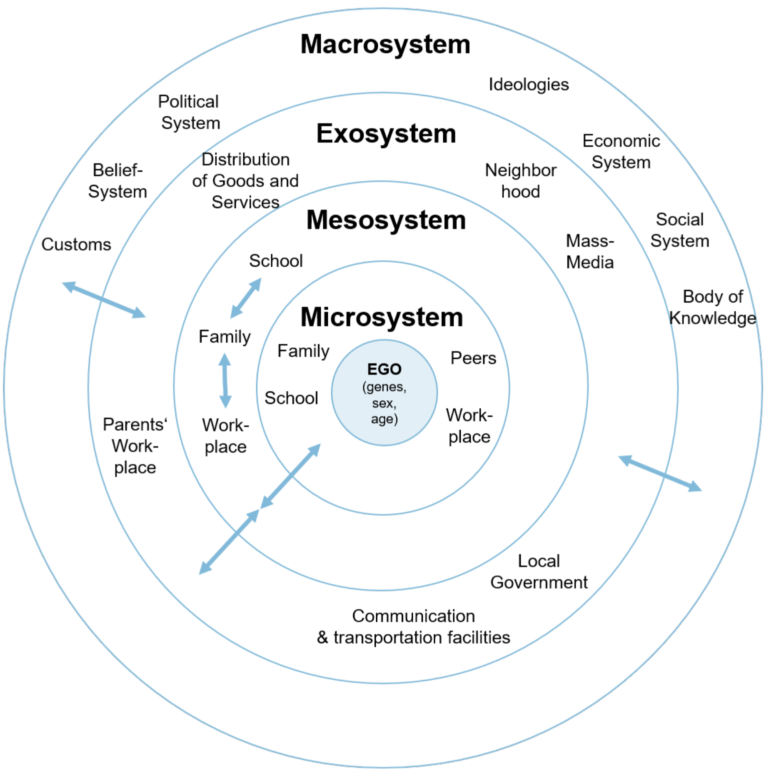
According to Urie Bronfenbrenner‘s (1995) model, individual development occurs in a particular socio-ecological context, and can only be understood by considering the entire ecological system within which it occurs. This ecological system comprises “a set of nested structures, each inside the next, like a set of Russian dolls” (Bronfenbrenner, 1996, p. 3). Figure 2.1 illustrates this system of nested structures. At the innermost level is the microsystem, which is nested into the meso-, exo-, and macrosystem. The microsystem is the complex of relations of the developing person and its immediate setting, where a setting is defined as “a place with particular physical features in which the participants engage in particular activities in particular roles (e.g. daughter, parent, teacher, employee) for particular periods of time” (Bronfenbrenner, 1977, p. 514).[1] The mesosystem is best understood as a system of microsystems. It contains linkages of different microsystems and settings which contain the developing person. For children, this might be interactions between the micro-systems of the school and the family. For adults, processes taking place between the family and the workplace, would be examples for the mesosystem. The exosystem additionally includes “other specific social structures, both formal and informal, that do not themselves contain the developing person but impinge upon or encompass the immediate settings in which that person is found, and thereby influence, delimit, or even determine what goes on there. These structures include the major institutions of the society, both deliberately structured and spontaneously evolving (...). They encompass, among other structures, the world of work, the neighborhood, the mass media, agencies of government (local, state, and national), the distribution of goods and services, communication and transportation facilities, and informal social networks” (Bronfenbrenner, 1977, p.

[1] Bronfenbrenner (1977, p. 517) continues the definition saying “the factors of place, time, physical features, activity, participant, and role constitute the elements of a setting”.

515).[2] Changes in the parents' workplace might for example affect the developing person indirectly through the effects on parents. Finally, the macrosystem consists of the entirety of the overarching institutional patterns, and implicit belief systems of which the other systems are concrete manifestations. It concerns economic, social, legal and political systems, but also bodies of knowledge, customs and ideologies that endow meaning and motivation.[3]

This dissertation explores how locus of control is affected by these different spheres and actors within them. The general discussion will reconnect the results of this exploration to the ecological model of development.

Figure 2.1: Bronfenbrenner's socio-ecological model of development



Note: The figure illustrates Bronfenbrenner's socio-ecological model of human development.
Source: Own illustration based on Bronfenbrenner (1977, 1995, 1996)

[2]Note the similarity between the exosystem and the 'principle of linked lives' in life course theory, which maintains that lives are lived interdependently and socio-historical influences are expressed through this network of shared relationships (Elder et al., 2003, p.13).

[3]In life-course theory, the macrosystem is represented in the 'principle of time and place'. According to this principle, "the life course of individuals is embedded and shaped by the historical times and places they experience over their lifetime" (Elder et al., 2003, p. 12).

2.2.2 Elder's life-course theory

Although the socio-ecological model is not restricted to a certain developmental phase, it makes sense to supplement this approach by another that focuses more explicitly on the temporal aspect. Therefore, the ecological model is supplemented by a life-course approach. "The life-course approach arose from a desire to understand social pathways, their developmental effects and their relation to personal and social-historical conditions" (Elder et al., 2003, p. 7). Just like Bronfenbrenner's model, the life course approach integrates information from different levels including macro-level information on social institutions and structures of society as well as micro experiences of individuals and their developmental pathways (Elder et al., 2003; Jr. Elder, 1994).

It exceeds Bronfenbrenner's model, however, by integrating developmental aspects. An important contribution to the formalization of the life course approach has been made by Glen Elder Jr. by formulating five central premises of the life course approach (Elder et al., 2003; Marshall and Mueller, 2003). These five premises are:
1) The principle of life-span development: Human development and aging are lifelong processes This principle highlights that developmental processes are not confined to childhood and adolescence but continue long into the life of an adult. This principle also includes the premise that "[l]ater years of aging cannot be understood in depth without knowledge of the prior life course" (Jr. Elder, 1994, p. 5). *2) The principle of agency:* "Individuals construct their own life course through the choices and actions they take within the opportunities and constraints of history and social circumstances" (Elder,1998, p. 4; Elder et al., 2003, p. 11). *3) The principle of time and place:* "The life course of individuals is embedded and shaped by the historical times and places they experience over their lifetime" (Elder, 1998, p. 3; Elder et al., 2003, p. 12). This principle points out that it is important to recognize that individuals and entire birth cohorts are influenced by the historical context and place, where place may mean either a geographical location, a material form or culture but also an investment with meaning and values (Elder et al., 2003). *4) The principle of timing:* "The developmental antecedents and consequences of life transitions, events and behavioral patterns vary according to their timing in a person‘s life" (Elder, 1998, p. 3; Elder et al., 2003, p. 12). The principle of timing points out that the same experiences or events may have very different effects on individuals depending on when they occur in a person's life (George, 1993). Even the meaning of the event may change depending on

the developmental stage. *5) The principle of linked lives:* lives are lived interdependently and socio-historical influences are expressed through this network of shared relationships (Elder et al., 2003, p. 13). This principle reminds of the fact that individuals do not exist in a social vacuum but live their life in various interrelations with others (Marshall and Mueller, 2003). While family is the most obvious example, individuals' options, choices and actions are also influenced by friends, colleagues and sometimes even by more remote social acquaintances. "Transitions in one person's life often entail transitions for other people as well" (Elder et al., 2003, p. 13). Also social changes on the macro-level often enter individual life courses through their impact on the network of shared relationships (Jr. Elder, 1998). Unemployment of the main breadwinner of the family inadvertently will affect the other family members, for example.

This dissertation explores how locus of control is affected by these principles. The general discussion will reconnect the results of this exploration to these premises of the life-course approach wherever possible.

Chapter 3

Clarification of the concept

Before delving into theoretical and empirical analysis, this chapter introduces the core concept of this thesis: Locus of control. After a short definition, the evolution of the concept out of Rotter's social learning theory is presented. Frequently used measurement instruments are introduced and the dimensionality of the concept is discussed. Empirical evidence on the stability of locus of control across time and age, as well as gender differences is summarized. The chapter also introduces comparable and related concepts, including learned helplessness and self-efficacy, and tries to explicate differences, similarities, and relationships between these concepts and locus of control. The last section reflects on the nature of locus of control as well as limitations of the concept.

3.1 Definition of Locus of Control

Locus of control describes the degree to which individuals "accept personal responsibility for what happens to them, in contrast to the attribution of responsibility to forces outside their control" (Battle and Rotter, 1963, p. 482). If a person believes that the course of his or her life is "contingent upon his [or her] own behavior or his [or her] own relatively permanent characteristic" then this person is described to have an *internal* locus of control (Rotter, 1966, p. 1). If the person believes that what happens to him or her is not entirely due to their own behavior, but to forces, which he or she cannot control, then this person is described to have an *external* locus of control (Rotter, 1966). Examples for such external forces might be the influence of powerful others, chance, fate, the general structure of society, or the individual's inability to understand the world due to the great complexity of the forces surrounding him or her (Battle and Rotter, 1963; Rotter, 1966).

3.2 Development of the concept out of social learning theory

The origin of the concept is typically attributed to Julian Rotter. He and his colleagues developed the concept as part of their social learning theory. Social learning theory integrates stimulus-response based reinforcement theories of learning[1] which focus exclusively on the relationship between patterns of reinforcements and behavioral responses, with cognitive theories of learning (Rotter, 1975). Rotter's (1954; 1960) social learning theory emphasizes the relevance of individual expectations and environmental aspects, and interactions thereof, in the learning process. Taking individual and situational aspects into account enabled social learning theory to account for the subjective nature of the effectiveness of reinforcements, which was not accounted for by traditional stimulus-response based theories of learning (Rotter, 1975).

The central idea of Rotter's social learning theory is that the effectiveness of a particular reinforcement depends on the degree to which the individual perceives the reinforcement as conditional on their behavior. This means that behavioral responses are not only determined by the nature of the reinforcement, as stimulus-response theory would have argued, but also by the individual's expectation of the relation between a particular behavior and the reinforcement in the given situation and the value of the reinforcement in the particular situation (Rotter, 1960, 1975). An accurate, clear and yet concise explanation of the concept, is probably best achieved by citing the author of the concept himself:

> "In its most basic form, the general formula for behavior is that the potential for a behavior to occur in any specific psychological situation is a function of the expectancy that the behavior will lead to a particular reinforcement in that situation and the value of that reinforcement" (Rotter, 1975, p. 57).[2]
>
> "If a person perceives a reinforcement as contingent upon his own behavior, then the occurrence of either a positive or negative reinforcement will strengthen or weaken potential for that behavior to recur in the same or similar situation. If he sees the reinforcement as being outside his own control or not contingent, that is depending upon chance, fate, powerful others, or unpredictable, then

[1] In stimulus-response based learning theory, "reinforcements act to strengthen the expectancy that a particular behavior or event will be followed by that reinforcement in the future" (Rotter, 1966, p. 2).

[2] Note that Rotter's social learning theory can be conceptualized as belonging to the class of expectancy-values theories. This will be discussed in greater detail in Chapter 5.

> the preceding behavior is less likely to be strengthened or weakened" (Rotter, 1966, p. 5).

Based upon these reflections, and the empirical results of his work, Rotter defines locus of control as follows:

> "Internal versus external control refers to the degree to which persons expect that a reinforcement or an outcome of their behavior is contingent on their own behavior or personal characteristics versus the degree to which persons expect that the reinforcement or outcome is a function of chance, luck, or fate, is under the control of powerful others, or is simply unpredictable" (Rotter, 1966, p. 1).

The contingency expectations, which stand at the center of locus of control, are formed based on the history of prior experiences of the degree to which own behavior is productive of certain results or not (Rotter, 1960). According to Rotter (1966) these expectations, are generalized from specific situations to a range of similar situations. Locus of control thus captures highly generalized expectations about the causal relationship between individual actions and outcomes. These generalized expectations operate across a broad range of situations. How relevant these generalized expectations are to a particular behavioral response depends on the familiarity of the situation and the knowledge of the person on the contingency of outcomes on own behavior in comparable situations. Locus of control is assumed "to have its maximum impact on behavior when individuals have little or no experience in the situation or when the situation is ambiguous, amorphous, or fluid" (Nowicki et al., 2018b, p. 2).

3.3 Measurement and dimensionality

After more than 50 years of research, a plethora of general and context-specific measures of locus of control have been developed.[3] This, on the one hand, reflects the centrality of the concept in many domains of life. On the other hand, it may also reflect the trade-off between a highly generalized measurement with low predictive power and a more specific definition and measurement, which has more predictive power but also a smaller scope. Connected to this "specificity-generality" problem, and the problem of measurement at

[3] By 1983, well over 30 item batteries for measuring locus of control, had been published (Nowicki and Duke, 1983).

large, is the question of dimensionality - i.e., whether the construct is uni-, bi- or multi-dimensional, and what dimensions it includes (Rotter, 1975). Because measurement and dimensionality are inherently bound up with each other, they will be treated jointly in this chapter. First, the current situation with regards to the measurement of locus of control is described by introducing the scales that have received most attention in the literature and discussing the recent upsurge in domain-specific locus of control measures. This description is then followed by a critical reflection on the consequences of this situation for the scientific inquiry of locus of control.

Rotter's original I-E scale

Initially, locus of control was thought to be uni-dimensional, with individuals being placed on a continuum between the two extremes of internality and externality (Rotter, 1966, 1975).[4] Rotter (1975, p. 62) developed a self-report scale, aiming to provide "a broad gauge instrument (...) to allow for a low degree of prediction of behavior across a wide range of potential situations" rather than "an instrument to allow for very high prediction in some specific situation". After several rounds of revision, the final instrument, which came to be known as the Rotter Internal-External scale (Rotter I-E scale), comprised 29 yes-no forced-choice items related to academic and social recognition, love and affection, dominance, social-political life, and questions of life in general (Furnham and Steele, 1993; Reich and Infurna, 2017). Factor analyses on this original Rotter I-E scale indicated that most of the variance was accounted for by a single factor (Rotter, 1975).

Shortly after the publication of the original scale, a number of authors suggested that the concept might be multidimensional (Abrahamson et al., 1973; Chandler and Dugovics, 1977; Dixon et al., 1976; Finch et al., 1981; Kleiber et al., 1973; Levenson, 1981; Lindal and Venables, 1983; Nowicki and Segal, 1974; Reid and Ware, 1973). These alternative suggestions differed in terms of the proposed number of dimensions, as well as the content of these dimensions. Additionally, the factor structure was sometimes found to differ by age and gender. Later factor analyses of the Rotter I-E scale revealed differing numbers of factors. Abrahamson et al. (1973), for example, found two factors, one focusing on luck and one on effort. Reid and Ware (1973) also found two factors: One focusing on individual outcomes (fatalism) and one measuring individuals' perception of their influence in the social and

[4] This becomes clear when Rotter talks about external *versus* internal control expectancy.

political realm (social system control). Kleiber et al. (1973) identified a three-dimensional structure, distinguishing between an internal factor, a factor for luck and fate, and one for external control exerted through social and political forces. Dixon et al. (1976) also identified a three-dimensional structure, but with slightly different factors: One measuring personal mastery, comparable to the internal factor by Kleiber (1973). The second factor measured control of political affairs, thus corresponding to the third factor identified by Kleiber (1973). The third factor centered around leadership and differed slightly between males and females.

Levenson's three-dimensional scale

More theoretically driven, Levenson (1981, p. 15) distinguished between an external factor for chance or fate that captures a belief in the "basic unordered and random nature of the world", and a second external factor for the belief in a basic ordered structure and predictability of events which are however perceived to be controlled by powerful others. She argued that while the latter view still leaves room for action –potentially even provokes it, the former does not (Levenson, 1974). As a consequence, Levenson's (1981) three-dimensional scale is often referred to as IPC-Scale (Internal, Powerful others, Chance). Factor analytical work on her scale is largely supportive of the three-dimensional structure without evidence for overlap between the scales (Furnham and Steele, 1993). In response to this evidence, (Rotter, 1975, p. 64) admitted that "it is clearly possible that we have two kinds of externals in our society". Rotter (1975), however, drew the distinction between passive externals and defensive externals. While the externality of the former simply reflects an external attitude, the latter hold external control beliefs as a defense mechanism (Mischel et al., 1974; Rotter, 1975). Levenson's three-dimensional scale is still frequently used in the literature, and some later domain or population specific scales of locus of control adopted the distinction within the external dimension (Wallston et al., 1978).[5]

Age specific scales of locus of control: the Nowicki-Strickland Scales

Another group of influential locus of control scales was developed by a group of researchers around Steven Nowicki at Emroy University. This group, comprising, among others, Marshal Duke and Bonnie Strickland, set out to develop a number of parallel, gen-

[5] Most of the short scales used in the empirical chapters of this theses are based on Levenson's (1981) three dimensional concept.

eralized locus of control scales for different age groups, which addressed some weaknesses in the Rotter I-E scale and would allow for comparable measurement of locus of control across the life-span (Nowicki and Duke, 1983).

The first of these age-specific locus of control scales was the Children's Nowicki-Strickland Internal-External Scale (CNS-IE) - a 40 item forced-choice, yes-no scale for children aged nine to eighteen with items focusing on achievement, dependency, and affiliation (Nowicki and Strickland, 1973; Strickland, 2017). Nowicki (1976) investigated the factor structure in three samples of elementary, junior high- and high-school children, with sample sizes of about 400 cases each. HE found a general factor for external control for all age groups that explained roughly 40 percent of the variance. The other factors were age- and sex-specific. For elementary school children the second factor focused on achievement and strength. For high-school children, two additional factors could be identified. The second factor was age-specific and focused on overcoming powerful others for males, while for females, the second factor consisted of items measuring the acceptance of fate. The third factor focused on the role of luck and chance for both sexes. Raine et al. (1981) also identified three factors, where the first focused on personal control and helplessness in social situations. The second factor captured beliefs in luck and fate, while the third factor comprised primarily positive outcomes and was therefore termed optimism. There was no evidence for a common factor on a higher level. In another analysis of the factor structure of the CNS-IE based on 20 of the 40 original items on a relatively large boys-only sample, Lindal and Venables (1983) discovered a four-dimensional structure after oblique rotation.[6] The first factor captured adolescents' struggle for autonomy, particularly in the home environment. The second factor termed reinforcement endowment and deprivation, captured the degree to which adolescents feel that positive outcomes are contingent on individual effort and work. The third factor, termed internal-external determinism, measured beliefs in good luck, wishing, and fate. The final factor captured adolescents' feelings of self-competence with regards to peers and was termed social-competence versus social impotence. In sum, the empirical evidence suggests that the CNS-IE scale measures three distinct dimensions, where one is related to luck and fate, one to the conditionality of positive outcomes on own effort, and one to control and helplessness in social situations.

[6] Usually, varimax rotation is used, assuming that the factors are not correlated. In this case, the authors used oblique rotation because they hypothesized factors to be correlated.

Additionally, Nowicki and Duke (1974b) constructed the Preschool and Primary Internal-External Control Scale (PPNS-IE) for children aged four to eight. It contained 28 forced-choice, yes-no items, 20 of which were taken from the CNS-IE in verbatim or a slightly altered form, plus eight new items that measured social desirability. Items were presented to children in a cartoon format, with different cartoons for boys and girls (Nowicki and Duke, 1974b). A similar approach to measuring locus of control in children is taken by the “Children’s Picture Test of Internal-External Control" by Battle and Rotter (1963). This test involves six cartoons showing situations which involve the attribution of responsibility. Children would respond to the question “What would he [the person in the picture] say?” with responses coded on a seven-point Likert scale ranging from internality to externality (Battle and Rotter, 1963). Investigations of the dimensionality of the PPNS-IE scales for children yielded relatively inconclusive results, with the additional complication that factor structure and content appeared to change with age, potentially reflecting different developmental stages (Nowicki, 1976). Nowicki and Duke (1974b) identified three factors in their PPNS-IE. The first factor referred to a general sense of power versus helplessness in peer relations, the second focused on determination through powerful others (primarily parents), and the third factor captured beliefs about luck and fate.[7] In an attempt to replicate these results based on three own samples, Herzberger et al. (1979) could not identify a sufficient item-total correlation for the PPNS-IE, nor could they find a reliable structure of sub-scales across samples and therefore raised doubt with the regards to the psychometric properties of the PPNS-IE in general. In their rebuttal Nowicki and Duke (1979) point out that the difference in results may be due to alterations of relevant procedure elements, such as omitting the cartoon format and replacing the yes-no answers with smiley and frowning faces.

On the basis of their children’s scales Nowicki and Duke (1974a) constructed a locus of control scale for adults which was more accessible to non-college-educated individuals and less biased by social desirability, than Rotter’s I-E scale, was biased by social desirability and required at least 10th-grade reading levels due to its difficult language (Nowicki and Duke, 1983). The Adult Nowicki-Strickland Internal-External Control Scale (ANS-IE) contained 40 binary (yes-no) forced-choice items and was constructed to be comparable to the different locus of control scales, which the Nowicki-Strickland group had developed for

[7]Note, however, that a minimum eigenvalue criterion of .8 was used for initial factor extraction, which is much less conservative than the conventional threshold of eigenvalues larger than one.

children. Factor analysis suggested that the ANS-IE measured a general factor of helplessness (external control), which explained about thirty percent of the variance (Nowicki and Duke, 1983).[8] The ANS-IE scale showed a positive, medium-sized, significant correlation with Rotter's I-E scale indicating that both scales thus measure a similar construct, but not in an identical way. Chandler and Patterson (1976) recast the binary ANS-IE into a Likert format, thereby reducing the skewness of the scale. For the Likert format Chandler and Dugovics (1977) found a four-dimensional structure for both males and females. These comprised a general factor for personal control, a factor for powerlessness, a blame factor, and factor for fate. In a fairly small study on 120 psychology students Finch et al. (1981) even found five dimensions for the ANS-IE scale, with factors relating to social impotence, luck, an effort-related factor, and helplessness.

Nowicki and his colleagues also developed a scale particularly for elderly people (Duke et al., 1974), which was closely aligned to the ANS-IE scale, but used past tense forms and had 'parents' changed for 'children' in some items. Dimensionality was assumed to equal that of the ANS-IE scale.

Measurement in the intercultural context

Most of the scales for Locus of control were developed and evaluated in western industrialized countries. Studies that tested the scales in an intercultural context have found comparable results with regards to the existence and dimensionality of the construct when samples where drawn from similar subgroups, for example with regards to their socio-economic positions (Nowicki and Duke, 1983; Smith et al., 1995). There is some variation in means of locus of control across cultures. (Mirowsky and Ross, 1984) for example report that individuals with a Mexican heritage tend to be more external than individuals with an Anglo-American heritage, independent of socio-economic status. Notwithstanding such differences in the means, the concept appears to be present across cultures (Smith et al., 1995).

[8] In a later factor analysis of the ANS-IE scale Dixon et al. (1976) found one factor concerned with control of social relationships. The second factor differed for men and women. For men, the second factor was centered around the importance of luck, while for females, the second factor measured the futility of effort.

Domain- and specific measures of locus of control

The contradictory evidence regarding the dimensionality of locus of control led some scholars to conclude that "the existence of an uni-dimensional generalized expectancy of control of reinforcements [...] was not supported" (Dixon et al., 1976, p. 318). Instead, so they suggested, domain-specific scales should be constructed (Dixon et al., 1976). This call for domain-specific locus of control scales is in line with a theoretical argument made by Ross et al. (2011), according to which the external, situational context conditions are more important than generalized control expectations in determining behavior (which is of course always specific to some context). Indeed, a plethora of domain- and population-specific locus of control scales have been constructed. Well-known, and frequently used are, for example, the general (Wallston et al., 1976) and multidimensional (Wallston et al., 1978) health locus of control scales and the Intellectual Achievement Responsibility Scale (IAR) (Crandall et al., 1965) - a locus of control scale focusing on intellectual-academic achievement situations. Another domain specific locus of control scale that is still relatively broad is the Multidimensional - Multiattributional Causality Scales by Lefcourt (1981) which comprise 24 items, measuring achievement and affiliation related locus of control. One advantage of this scale is that the different domains load on two higher-level internal external scales of 12 items each. While the locus of control scales above are still relatively broad, domain-specific locus of control scales have also been developed for a very specific set of outcomes such as smoking (Bunch and Schneider, 1991), drinking (Donovan and O'Leary, 1978), fetal health (Labs and Wurtele, 1986), maternal labor and delivery outcomes (Schroeder, 1985) and aviation safety (Hunter, 2002), to name just some of them.[9]

Additional short-scales

In addition to the general and domain-specific scales, a plethora of short-scales of locus of control have been developed, which are usually based on one of the main or domain-specific scales but include less items, to allow measurement of locus of control in a short and easy to administer way. These short scales have exacerbated the impermeability of the measurement situation further.

[9] For a more comprehensive list of domain-specific locus of control scales see the summary and discussion by (Furnham and Steele, 1993; Turnipseed, 2014).

Summary and evaluation

When considering the jungle of measurement instruments for locus of control and the resulting confusion with regards to its dimensionality it seems that a 30-year-old evaluation of the situation by Furnham and Steele (1993, p. 444)is more true than ever.

> Furnham (1990) has suggested that the development of such trait-personality dimensions usually proceeds through eight identifiable stages: The description of the phenomenon; replications of the effect; the development of a self-report measure; validation of that measure; factor-analytic (or other multivariate) research suggesting scale multi-dimensionality; the development, simultaneously, of multiple, multidimensional measures; doubts about the veridicality or conceptual usefulness of the original work; and finally acceptance into the canon of psychology. The locus of control concept has certainly gone through all of these phases, but the past decade suggests a certain 'fixation' at the sixth stage, namely the development of new measures.

What implication does this have for locus of control research and what would be a good way forward? Before tackling the broader question of the usefulness of additional measures of locus of control, the question of dimensionality should be considered. There are a few conclusions that can be drawn from the abundance of empirical evidence on this point. Firstly, there is considerable doubt as to whether locus of control is best represented as a uni-dimensional construct. Secondly, although the evidence seems to suggest some multi-dimensionality, the number of dimensions and their contents is highly controversial. Several things must be considered in interpreting the results of the factor-analytical studies which led to this controversy: Some of these studies were based on particularly small, sometimes selective sample sizes. Some did not even fulfill the requirements for acceptable sample sizes for the conducted analyses, such as a minimum of five observations per item (Finch et al., 1981). Studies that do not fulfill such minimal requirements should be consistently excluded from the debate.

Even when scientific standards are fulfilled, relying on factor-analytic studies rather than a theoretically-driven approach to determine the dimensionality of a construct may be misleading. The factors retained in a factor-analysis necessarily depends on the specific items of the scale. Considering that the studies cited above used different sets (or subsets) of items, it is little surprising that they find different factor structures. According to Rotter (1975, p. 63), factor analytical analyses do not reveal the "true structure of the construct; they only reveal the kinds of similarities perceived by a particular group for a particular selection of items". He maintains, however, that individual items still correlate with a general factor and that any sub-dimensions should also be correlated (Rotter, 1975). Nowicki (1976) also demands that locus of control measures should be constructed so as to yield a general score as well as more specific sub-scales, which would allow researchers to choose the appropriate measure for their research. This rather practically oriented suggestion could be very useful, as such a flexible, multidimensional, multi-level scale may help to consolidate the compartmentalized measurement that plagues locus of control research by making comparisons across studies using different measures difficult, if not impossible. The same is true for the increasing number of narrow-domain specific locus of control scales. Frequently, and unsurprisingly, correlations of these scales with each other, and generalized locus of control measures are rather low. Although the development of very specific scales is attractive, because with more specific measurement, predictive power is increased, it is questionable whether the complete compartmentalization of control-beliefs will further scientific inquiry, as it prevents comparability across domains and increases the impenetrability of the debate (Furnham and Steele, 1993; Turnipseed, 2014). "Perhaps a few broad-context locus of control scales (e.g., work, health), consistent with the general locus of control theory, could be properly developed and used rather than the plethora of narrow, context-specific measures" (Turnipseed, 2014, p. 2).

In sum, a more theory-driven approach to the dimensionality discussion would be desirable. Skinner (2017) has provided an analytical framework that may be helpful here. She points out that although the *dimensionality may be primarily bi-polar* (internal-external) with potentially several sub-dimensions, *causal beliefs may be multidimensional* - especially at the external dimension one wants to add. What she means is that there are more than one rationales for holding external, but also internal control expectancies. One may, for example, hold external control expectancies because one feels determined by powerful others, the general complexity of the world, or pure fate. The distinction between polarity and causal beliefs may help to give some structure to the debate. Because causal beliefs may be independent of one another, factor analytic studies have found different numbers of dimensions, depending on the number of items that were included to measure different causal beliefs. Based on these thoughts, a multidimensional measurement of locus of control, that reflects theoretically possible causal attributions and is reducible to a generalized scale with bipolar dimensionality, would be a promising way forward. This would then also be congruent with Furnham's 30 year old analysis of the typical stages of the measurement debate of complex personality traits.

3.4 Development and stability of Locus of Control

According to Skinner's (2017, p. 328) recent review, "[t]here is not yet a robust literature systematically documenting developmental changes in how perceived control is organized and functions". They may partly be due to the measurement problem discussed above. Notwithstanding these difficulties, this section aims to take a closer look at the stability of locus of control and its development across the life-span. Knowing when and how locus of control is formed, whether it is stable after a phase of consolidation or adjusted continuously to new experiences, is relevant as the specific answers to these questions need to be considered by scientists in their research designs. For example, the point in a child's development when it can capture the concept of causality and conditionality provides a lower bound for the age at which researchers can start to measure locus of control. When locus of control is continuously updated, longitudinal data may be required for some questions, whereas cross-sectional data may suffice if locus of control remains stable from a certain point onwards. In addition to that, knowledge of changes in the mean level of certain traits across historical time may be indicative of certain changes in societal or cultural demands on individuals. Observation and consideration of such large scale changes is this of special importance to sociological research.

In general, stability and development of trait-like characteristics are assessed by different methods depending on whether interest lies at the individual or group level and whether one is interested in absolute or relative changes. Table 3.1 provides an overview of these measurement concepts and their application.

Mean-level stability assesses changes in the absolute level of certain characteristics at the population level. Studies on mean-level changes may be further differentiated into those that look at increases and decreases *across time* and those that focus on age-dependent

Table 3.1: Measuring trait-stability

	group level	**individual level**
absolute change	mean-level stability	intra-individual stability
relative change	rank-order consistency	ipsitative stability

Note: The Table categorizes common measures of trait-stability depending on whether they measure absolute or relative change, and whether change is measured at the individual or the group level.

changes in locus of control, that is, mean level changes *across the life-span* (Roberts and DelVecchio, 2000). While the former investigate historical changes in a trait, the latter look at maturational changes. Maturational changes may either reflect changes in the capabilities of agents, or they may be responses to societal demands that are associated with the roles that are taken-up as part of the life course (Cobb-Clark and Schurer, 2013). Mean level changes across time measure population-level changes in a trait across cohorts. Studies investigating mean-level changes across time often utilize data from different birth cohorts, where traits are ideally measured at the same age of respondents. Such changes across time may reflect changes in societal demands in a trait. Intra-individual stability measures changes in the absolute level of traits within a single individual. The difficulty here is to distinguish real change from measurement error.

Rank-order consistency (also referred to as differential stability or rank-order stability) looks at relative differences between individuals across time(Roberts et al., 2008). It tracks changes in the relative placement of an individual within a group over time. Rank-order consistency thus looks at the ordering of individuals within a group of people with regards to a single trait. Note that mean-level stability may be high, even if there are significant changes in the trait level of certain groups. These changes, which concern certain subgroups, but not the entire population, are captured by rank-order stability.

On the individual level, ipsitative stability measures the relative ordering of constructs within a person over time and age. Ipsitative stability thus looks at changes in the structure of personality for individuals.[10]

The following sections will briefly review the empirical research, and to some extent,

[10]Studies on ipsitative stability of personality indicate that the structure of personality is relatively stable in adulthood and childhood, while the structure of personality seems to undergo some significant changes in adolescence and early adulthood (Roberts et al., 2008).

also theoretical arguments concerning the development and stability of locus of control. Particular focus will be placed on mean-level changes over the life-course and across time, and intra-individual changes as these are most relevant for this thesis.

3.4.1 Mean-level stability in locus of control across the life-course

The bulk of empirical research on the stability of locus of control focuses on mean level changes across the life-course. Parts of the literature are based on cross-sectional data, pooling individuals of the same age, while other parts are based on longitudinal surveys. The latter likely provide a more accurate picture because cross-sectional studies that pool individuals of different ages capture potential cohort effects in addition to maturational effects. Results from both types of studies will be presented and differences will be discussed. The following review of theoretical arguments for stability and change, and empirical evidence thereof, is organized along the life-course, covering development and accumulation of locus of control in early life, maturation and consolidation in adolescence and early adulthood and either, further strengthening or erosion of the sense of control in adulthood and old age.

Childhood:

Beginning with the neonatal phase, infants can experience the contingency of outcomes on their own behaviors. These experiences depend to a large extent on care-takers' responsiveness to their expressions of need. Different theories regarding the initial formation and development of locus of control in young children were put forward. Influenced by the psychoanalytical concept of infantile omnipotence and Jean Piaget's work, which demonstrated that children greatly tend to overestimate their effect on the world[11], some scholars hypothesized very young children to have unrealistically high internal control perceptions, which are then gradually adjusted to incorporate more externality, as children come to realize that their effect on the world is limited (Skinner, 2017; Weisz and Stipek, 1982). Others assumed that children start off with highly external control beliefs reflecting their unconditional dependence on others and then gradually move towards more internality as their increasing competences allow for more experiences of self-efficacy (Nowicki et al.,

[11] Piaget documented strong overestimation of the own causal influence on the world, in expressions such as "The sun goes down because I have to go to bed." (Piaget et al., 2000). Meanwhile, it is known that this infantile egocentricity is due to a dominance of the right hemisphere, which represents the embodied self, and that ego-centrism lessens with the development of the left-hemispheric cortex, which makes children realize that the world has an existence separate from their own (Crago, 2017).

2018b). While contradictory at first glance, there are several ways to reconcile these two accounts. Skinner (2017) suggests that children maintain an internal sense of control if their belief in omnipotence is replaced by a sense of self-efficacy and an understanding that their ability to effectively influence outcomes are a function of effort, ability, and effective strategies and that all of these can be developed. "The construction of this view requires all the social supports needed to develop actual competencies as well as the pervasive experience of effective interactions with the social and physical world, scaffolding that offers good tactical suggestions, and interpretations that maintain focus on the task and approaches to mastering it. If children do not have these experiences, if they do not develop a growth mindset[12] and real competencies, omnipotence is replaced by the development of helplessness[13]" (Skinner, 2017, p. 330). Also, distinct dimensions of locus of control may follow different, independent, developmental patterns.

The empirical evidence on early childhood is not conclusive. Several studies have found internal control expectations to increase with age (Lefcourt, 1982; Prevoo and Weel, 2014). Overall, however, stability of locus of control in childhood appears to be rather low. Nowicki et al. (2018b) finds a correlation of 0.22 for measures of locus control between age eight and age sixteen. Schneewind (1997) also finds a correlation of 0.20 for locus of control measured at the age of ten and again at sixteen. Nowicki et al. (2018b) conclude that the developmental changes that take place in childhood have profound effects on children's control perceptions.

Adolescence and young adulthood:

Adolescence and young adulthood can be conceptualized as a phase when actual control over one's environment reaches a climax. Independence of the parental household, both financially as well as locally, coincides with educational and occupational choices, all of which allow experiencing control over one's life. Therefore internal locus of control could be expected to reach a climax in this developmental phase. Meta-analyses of psychological research on mean-level stability of personality traits indicate that the most substantial mean-level changes occur during young adulthood (Roberts and DelVecchio, 2000). This also seems to be true for locus of control: The vast majority of studies indicate that locus

[12]Growth mindset is a concept developed by Carol Dweck (2017). According to Dweck individuals tend towards either of two mindsets, where one is focused on growth and mastering challenges through persistence and effort while the other mindset is focused on limitations and thus leads to less engagement in demanding tasks.

[13]Helplessness is a concept related to external locus of control and discussed in Section 3.6.

of control increases during adolescence and young adulthood. In a longitudinal framework based on data from the BCS70, Prevoo and Weel (2014), for example, reported that locus of control increased between the age of 10 and 16. In another longitudinal study based on data from the National Longitudinal Study of Youth (NLSY), which followed young individuals aged 14 to 22 for 13 years, Lewis et al. (1999) found that locus of control increased for all individuals but less so for those who were older at the beginning. In this study, the increase in locus of control, thus leveled off in early adulthood.

Adulthood and old age:

Midlife has been conceptualized as a developmentally interesting phase in which processes of growth and decline intersect (Lachman, 2015; Lachman et al., 2015). These processes may affect control perceptions in differing ways. Scholars of locus of control maintain that the sense of control achieved earlier might be challenged in adulthood (Mirowsky and Ross, 2007; Skinner, 2017). "Adults come to realize that society imposes decisive constraints on the people and competencies that will be rewarded, that history changes contingencies even within our lifetimes, that chance and fate play key roles in all of life's successes and failures, that even our own abilities are to some degree a matter of luck, and that the really important outcomes –death of self and loved ones –have always been out of human control" (Skinner, 2017, p. 330). Hence in this phase limits of contingency and the narrow range of outcomes that can potentially be influenced become more salient such that internal control expectations decrease while external control expectations are hypothesized to rise. These hypotheses are generally corroborated by the empirical literature, although there is some disagreement regarding the onset of the decline and the developmental trajectory in old age.

Cross-sectional studies of mean-level stability in (American and Canadian) adults found an inverted-u shaped pattern for internal locus of control, with a small increase in early adulthood, that levels off between 30 and 40, followed by a decline into old age (Mirowsky, 1995). In a cross-sectional analysis of data from the Socio-economic Panel Study (SOEP) Specht et al. (2013) found a similar pattern with increases in internal control until middle adulthood, followed by a decline until approximately age 60. In contrast to former studies, Specht et al. (2013) found a slight increase in old age. Specht et al. (2013) pointed to differences in the social-security systems in Germany and North America to explain the difference in findings. The more substantial social-security system in Germany may allow a greater sense of control over their lives after retirement. In contrast, Americans might more often be faced with high costs for medical treatments and thus feel more externally determined.

Results based on longitudinal studies depend to a large extent on the amount of time between measurements. Studies with smaller intervals of one to five years between measurements indicate that locus of control is relatively stable in the short-to-medium run, especially in mid-adulthood. Using data from the Household, Income and Labour Dynamics in Australia (HILDA) on a population aged 15 and older, (Cobb-Clark and Schurer, 2013) found very little change in locus of control among the working-age population (25-59) over four years. Among the young and the old, they observed some changes, however. While those below 20 became more internal over the course of four years, individuals aged 70 and above became more external.

Studies with longer periods between the measurements typically reported more substantial changes in locus of control. In general, however, longitudinal studies mostly confirmed the results found in the cross-section. This includes, in particular, the increase in internal locus of control in early adulthood, followed by a decrease in late adulthood (Cobb-Clark and Schurer, 2013; Mirowsky and Ross, 2007; Sherman et al., 1997; Specht et al., 2013). Studies following an adult sample of Americans for a six year period from 1995 to 2001 reported a much later onset of the decrease (around the age of 50) than indicated by cross-sectional studies (Mirowsky and Ross, 2007; Ross and Mirowsky, 2002).[14] They also found increases in early adulthood to be much steeper than indicated by cross-sectional studies. Gatz and Karel (1993) found increases in internal locus of control over the course of 20 years, for almost all age groups. In another study that followed a representative sample of the adult Germans for a six year period, Specht et al. (2013) found a decrease in locus of control over the course of six years for all age groups. The decrease was less strong for younger individuals.[15] The increase in locus of control found in the cross-sectional analysis of the same data was thus slightly mirrored in the longitudinal results.

Several scholars have pointed out that the inconclusive results with regards to the development of locus of control in old age in cross-sectional and longitudinal studies might be artifacts of cohort effects and differential living conditions in old age in different countries

[14] The studies were based on data from the Study of Aging, Status, and the Sense of Control (ASOC), a national telephone probability sample of 2,592 U.S. households, in which individuals aged 60 or older were over-sampled (Mirowsky and Ross, 2007).

[15] Due to a change in the answer format between the two measurements, this result should be treated with caution.

(Mirowsky and Ross, 2007; Specht et al., 2013). Drawing on results from cohort studies allows the speculation that the old-age decline, which is frequently found in cross-sectional studies, might reflect a cohort effect, rather than a real decline (Mirowsky and Ross, 2007). This interpretation would be consistent with several studies that do not find a decrease in perceived control in old age (Heckhausen and Schulz, 1995; Lachman, 1986; Specht et al., 2013).

3.4.2 Rank-order stability of locus of control

Different hypotheses on the development of rank-order-stability have been put forward. While defenders of an essentialist perspective on personality[16] would expect rank-order stability to be relatively high, those who believe in contextual influences on personality would expect rank-order stability to be relatively low (Roberts et al., 2008).

Unsurprisingly, rank-order consistency for complex personality traits is much higher in the medium to short-run than in the long run (Roberts et al., 2008). This is also true for locus of control. Measured on a year-to-year basis, rank-consistency of locus of control is as high as 0.8 (Gecas, 1989; Mirowsky and Ross, 2007). Across the life-span rank-order stability has been found to increase by some studies (Roberts and DelVecchio, 2000) while other studies pointed towards an inverted u-shape, with high levels of stability in middle adulthood and less stability in early adulthood and old age (Lucas and Donnellan, 2011; Specht et al., 2013). In a study of a representative sample of adults in Germany, mean rank-order consistency in a six year interval for the entire sample was 0.58 (Specht et al., 2013). "Perceived control showed neither the common inverted u-shaped function nor the steadily increasing course" in rank-order stability (Specht et al., 2013, p.362). Instead, age had a cubic influence on rank-order consistency. Rank-order stability was fairly low in this 6 year interval for young adults (below 0.5 for those aged 30 and younger) but increased until the age of 40 (reaching 0.6 at the peak) and then decreased slightly before rising again after the age of 70. The low rank-order stability in early adulthood is consistent with patterns of rank-order consistency for other traits (Lucas and Donnellan, 2011; Specht et al., 2011b) and is likely to be a consequence of major life transitions, such as transition into employment or parenthood, which are experienced by different individuals at different time-points in this period. Overall, rank-order stability for locus of control has been found

[16] According to the essentialist perspective traits are "endogenous dispositions that follow intrinsic paths of development essentially independent of environmental influences" (McCrae et al., 2000, p. 173).

to be rather low compared to other personality traits, including the Big Five (Lucas and Donnellan, 2011; Specht et al., 2011b). To allow a comparison: At the peak in middle adulthood, rank order stability of the Big Five ranges between .68 (Agreeableness) to 0.78 (Extraversion). Hence, there appear to be many changes in the locus of control ranks of individuals, indicating that locus of control is subject to changes far into late adulthood.

3.4.3 Mean-level changes in locus of control across time

Observed changes in the mean-levels of locus of control across cohorts may, on the one hand, reflect changes in individuals' actual opportunities to control their outcomes. On the other hand, such changes may be due to normative forces that demand greater individual responsibility for individual outcomes, regardless of changes in the individual's actual level of influence on the respective outcomes.

Naturally, the development of the locus of control construct in the late 1960s marks the starting point for empirically testable theoretical considerations of societal and historical influences on the average level of internal and external control expectations in the population of a particular culture. Since the development of the construct, societal and technological advancements brought greater freedom of choice in many aspects of life. Twenge (2004) points to birth control, transportation (also long distance), technological inventions, less strict social rules, and more openness for different gender definitions and sexual preferences to name only some of these, potentially wide-ranging social and technological innovations. These advances in actual control may have increased internal control expectations on average (Twenge et al., 2004).

The same time period beheld however also a number of developments, which could be hypothesized to foster increases in external control convictions. Firstly, this time period witnessed a remarkable increase in structuralist as well as psychological explanations of individual phenomena, not only in academia but also in the public debate (Twenge et al., 2004). In their meta-analysis of research on mean-level changes in locus of control across time, Twenge et al. (2004) cite an impressively broad body of research to illustrate that structuralist and psychological explanations of individual behavior were much less present public discourse before the late 60s. One of their sources points out, for example, that reference to experiences made in childhood in legal defense strategies had been increasing (Sykes, 1992, in Twenge (2004)). The coincidence of these developments is sociologically as well as psychologically interesting. The distinction between primary and secondary control suggested by Rothbaum et al. (1982) and Heckhausen and Schulz (1995) can be employed to explicate this coincidence. While the various social movements of the late 1960s, which helped to bring about some of the societal changes mentioned above, can represent instances of primary control - that is behavior directed at the external environment that attempts to achieve certain outcomes, the increase in structuralist and psychological explanations may be conceptualized as an instance of secondary control. Secondary control is internally directed and aims to either maintain primary control or to cope with experiences of loss of primary control. The increasing compartmentalization of the world of work may have lead to feelings of alienation and consequently increases in external (or decreases in internal) control. Furthermore, unique historical events with far-reaching effects on individual's everyday lives could also be expected to have an effect on locus of control. Such events may raise the awareness of the limitations of individuals to effectively influence their surroundings. The fall of the Berlin Wall and the subsequent process of economic reorganization with all its socio-economic consequences, may have made the affected people very aware of the limits of their influence and thus increased external locus of control - at least in the short run.[17] Other examples for such events might be the Vietnam War, the Chernobyl disaster, large-scale economic crisis, the Brexit, or the current COVID-19 Pandemic. The list of such events is fairly long. Broader media-coverage of negative (and especially unpredictable) events, may exacerbate feelings of powerlessness and thus also promote externality (Twenge et al., 2004).

The strength of each of these forces is difficult to pin down, as empirical studies will only capture their joint effect. Using data on four generations of families from the Longitudinal Study of Generations Gatz and Karel (1993) found a trend towards more internality between 1971 and 1991 for all subgroups except for young men. The authors interpret their finding to exemplify general societal trend towards more individuality and individualized responsibility. In a meta-analysis of 97 studies sampling college students Twenge et al. (2004) investigated changes in mean-level of locus of control between 1960 and 2000. He found that the Rotter I-E scale for college students had become substantially more external (about .8 of a standard deviation) during this time. Birth cohort explained 14 percent of the variance in locus of control scores. This means that "the average college student

[17]Comparing the locus of control of German individuals born right before and right after the fall of the Berlin wall Kleinjans and Gill (2018) finds individuals born in eastern Germany right before the fall of the wall to be more external than individuals born in western Germany before. The statistical difference disappears for the birth cohorts 1989 to 1982.

in 2002 had a more external locus of control than 80 [percent] of college students in the early 1960s" (Twenge et al., 2004, p. 315). The same trend towards greater externality was found for 41 samples of children aged 9 to 14 for the period between 1970 and 1990. Twenge (2004. p. 315) concluded that even children "as young as age 9, increasingly feel that their lives are controlled by outside forces rather than their own efforts". In another study of U.S. high school seniors that covered cohorts from 1976 to 2006, Trzesniewski and Donnellan (2010) could not identify a significant relationship between birth cohort and locus of control.[18]

3.4.4 Summary

In sum, the evidence suggests that locus of control changes across the life-span, reflecting maturational processes. These include changes in cognitive and physical abilities, but also changes in the competence system which are induced by age-dependent normative or contextual demands (Skinner, 2017). The empirical evidence suggests that locus of control is formed in childhood, becomes more internal with early adulthood, and then reverts to lower levels of internality due to the realization of the limits of control in adulthood. Although year-to-year correlations are as high as 0.8, these small changes, which reflect the medium-run stability of locus of control, add up over the years, leaving considerable room for changes in the long-run (Mirowsky and Ross, 2007). Nowicki et al. (2018b)[19] and Schneewind (1997)[20], for example, reported correlations of 0.5 after 16 years, and Gatz and Karel (1993) found a correlation of 0.33 after 20 years. The sum of the evidence suggests, therefore, that locus of control is constantly updated based on the experiences made and that it changes across the life-span, reflection maturational processes. This strengthens the case for locus of control research to adopt a life-course perspective. At the same time, the malleability of locus of control provides room for intervention. This may be of interest to practitioners, for example, in education. The scant evidence on mean-level changes across time indicates that locus of control is not only affected by proximal processes, but also by changes in cultural and societal demands. Hence, analyses of locus of control should keep in mind that the context in which locus of control develops and unfolds consists of multiple nested layers, each of which may affect locus of control simultaneously.

[18] In contrast to Twenge's meta-analysis, which only included studies using established measurement instruments, they used a non-validated measure of 7 items, which only reached a Cronbachs alpha of 0.66.

[19] Locus of control was measured three times at mean ages of 26-29, 32-35 and 44-49.

[20] The study was based on a sample of 100 adults with an average age of 36.

3.5 Gender differences

This section is concerned with gender differences in locus of control. The empirical evidence suggests that there are notable differences between sexes when it comes to control perceptions. These differences concern factor-structure, mean-levels, and developmental trajectories. Differences in terms of factor-structure have briefly been discussed in section 3.3. Differences in terms of mean-levels and developmental trajectories will be portrayed in the following.

In general, males have been found to believe to be more in control of their lives than females (Ross and Mirowsky, 2002; Sherman et al., 1997; Specht et al., 2013). This 'gender-control gap' is in line with personal control theory, according to which, perceived control reflects actual, or objective control (Mirowsky and Ross, 1983). "[W]omen have a lower sense of control over their lives than men as a result of economic dependency, restricted opportunities, role overload, and the routine nature of housework and women's jobs" Ross and Mirowsky (2013, p. 386).[21] If perceptions of control follow actual opportunity structures, the gender gap should be more pronounced for older age groups. Gatz and Karel (1993) and Ross and Mirowsky (2002) provided evidence in favor of this hypothesis. Ross and Mirowsky (2002) also showed that parts of the observed gap could be explained by education, personal employment history, and physical functioning. Fairness of domestic labor and self-reported health did not contribute to the gender-control-gap. Other studies question the existence of a cohort effect on the gender-control gap (Specht et al., 2013). A study by Kuther (1998) suggests that the gender-gap in mean levels is due to gender-roles rather than biological sex (Kuther, 1998). According to this study locus of control varies with sex-role orientation for females, but not for males. Females that scored higher on the feminism scale were found to be more external, whereas females with a stronger masculine self-perception were found to be more internal (Kuther, 1998).

Several studies also indicate that females become more external than males over the

[21] According to controversial evidence by Doherty (1983), this gender gap emerged only in the 1970s in consequence of increased awareness of discrimination and differential opportunity structures faced by women. The authors found no gender differences in locus of control in younger and older women in the late 1960s and early 1970s. By the late 1970s, these women have become substantially more external in both age groups. The observed changes in locus of control could not be explained by demographic factors. Re-analyses of the same data indicated, however, that the results were driven by coding errors (Smith and Dechter, 1991).

life-course. This differential development seems to begin in adolescence(Kulas, 1996) and to continue in adulthood (Cobb-Clark and Schurer, 2013; Doherty, 1983; Ross and Mirowsky, 2002). In an early longitudinal study using National Longitudinal Survey of Labour Market Experiences (NLS) data, Doherty and Baldwin (1985) found that men's control perceptions remained relatively stable, while females tended to become more external. Similarly, Cobb-Clark and Schurer (2013) reported that females become slightly more external over the course of four-year follow-up study. Again, Specht et al. (2013) found no evidence of differential developmental trajectories of men and women.

Males and females also appear to differ in their control perceptions in different domains (Sherman et al., 1997). In their meta-analysis of gender differences in locus of control, Sherman et al. (1997) found that the factor structure of perceived control frequently differs for males and females. While the primary factor of locus of control is usually quite similar for males and females, differences become apparent at the level of secondary factors. Females feel more in control of interpersonal relationships, whereas males feel more competent to control circumstances, which, in fact, cannot be controlled. This research also indicates that part of the observed gender-differences in many locus of control measures may be due to the lack of items on intra-personal relationships in the respective measurement scales. Sherman et al. (1997) conclude that multidimensional locus of control scales may be particularly useful to researchers interested in gender-differences in locus of control.

The evidence reviewed here thus seems to suggest that females are frequently found to be more external, and to become more external over time. The gender-gap in perceived control may on the one hand be a reflection of females more restricted opportunities. This is supported by research that finds the gender gap to be more pronounced among elder women and that parts of the gap can be explained by factors such as education and personal employment history. This point is also supported by research that indicates that the gap is more pronounced for females with a more feminist orientation. On the other hand, the observed gender-gap may at least partly be an artifact of the measurement instruments and the lack of items on interpersonal control therein. Although there are some studies that question the existence of a gender-gap in locus of control, the evidence that supports such a gap, both in means, and in developmental trajectories over-weighs. Therefore, gender differences should be taken into account in the following analyses.

3.6 Distinction from related concepts

Thirty years after Rotter's first publication Skinner (1996) recorded approximately 100 constructs related to the broader concept of control. Nevertheless, Skinner (1996, p. 551) felt that "it is virtually impossible to assert that any list of terms is exhaustive". Related concepts she had cataloged sometimes, but not always, include the term control. Examples of related concepts including the term control are personal control, sense of control (Abeles Ronald, 1990), control beliefs (Skinner et al., 1988) and perceived control (Skinner, 1995). Examples for concepts that do not explicitly include the term 'control', but are nevertheless closely related, are helplessness (Seligman et al., 1975), mastery (Pearlin et al., 1981), competence(Weisz and Stipek, 1982) and efficacy (Bandura, 1977a).[22] As a consequence of this plethora of related concepts, the broader concept of control suffers from a twofold conceptual imprecision known as *'jingle-jangle fallacy'* (Kelley, 1927). The *jingle fallacy* applies when the same term or label is used to refer to different constructs. The jingle fallacy also plagues locus of control. Researchers often use this term even when they are not referring to Rotter's definition of the concept. (Cobb-Clark and Schurer, 2013), for example, use a measurement instrument for mastery and yet refer to locus of control in their title. The reverse case, i.e., *jangle fallacy*, applies when there are many labels to describe a single construct. The *jangle-fallacy* also plagues locus of control. Within different strands of research, various concepts describe expectations about the relation between individual actions and outcomes. Examples for such closely related constructs are Bandura's *response-outcome expectancies* which describe a person's estimate that a given behavior will lead to certain outcomes, Heckhausen's *action-outcome expectancy*, which describes the subjective probability that one's actions will modify a situation, or Seligman's (1975) *contingency* term, which also describes individuals' assessments of the contingency of outcomes on one's behavior. *Perceived control* is frequently used as a synonym to Rotter's concept of locus of control as well as to the concepts mentioned above and possibly even more related concepts (Nowicki and Duke, 2017). Hence, another case of jingle-fallacy, related to locus of control.

This multitude of related concepts entails a lack of clarity on the theoretical level, which generates several empirical and practical problems. Researchers need to decide which concept provides the best fit with their theory and research question. The choice

[22] A definition of all these terms, and many others, is provided in the appendix of Skinner (1996).

of the concept is, however, often driven by data availability rather than ideal conceptual fit. Un-ideal concept-fit may blur the theoretical argumentation and weaken the empirical relationship. Sometimes more than one concept is included, to avoid the choice, or to capture different aspects of the concepts. Including several related concepts at once reduces the predictive power of each individual concept, however.

Another problem is the evolution of more or less independent strands of literature around each of these concepts. Literature reviews usually concentrate on just one concept (Gecas, 1989; Peterson and Buchanan, 1995; Reich and Infurna, 2017). Although references to the literature on related concepts are sometimes made, the sheer amount of related concepts makes it almost impossible to keep track of all strands of literature and thus prevents a thorough integration of findings. Whenever related research remains unconnected, opportunities to learn from other strands of literature remain unused.

Despite the obvious overlap, there are slight differences between the related concepts, which their respective authors have been keen to point out. These differences may concern the analytical depths or the particular emphasis of the concept on a specific aspect of the relationship between perceived or actual control and own actions. There is a limited number of studies that have investigated the discriminant validity of some of these related concepts (Judge et al., 2002; Marsh et al., 2019; Peterson and Stunkard, 1992). Before discussing the results of these studies, some of the most relevant related concepts shall be presented in a little more detail.

3.6.1 Self-efficacy

One closely related concept that received a comparable amount of academic interest is the concept of 'self-efficacy' [23]. Like locus of control, the concept of self-efficacy originates from social learning theory. Albert Bandura (1977) posited self-efficacy expectations as a central determinant of behavioral change.[24] According to his theory, whether a particular action is exerted depends on two cognitive evaluations: outcome-expectations and efficacy-expectations. (For a graphical representation of Bandura's theory, see Figure 3.1. Outcome-expectations are subjective estimates on whether a given behavior will lead to a particular outcome. Efficacy expectations are convictions about whether "one can suc-

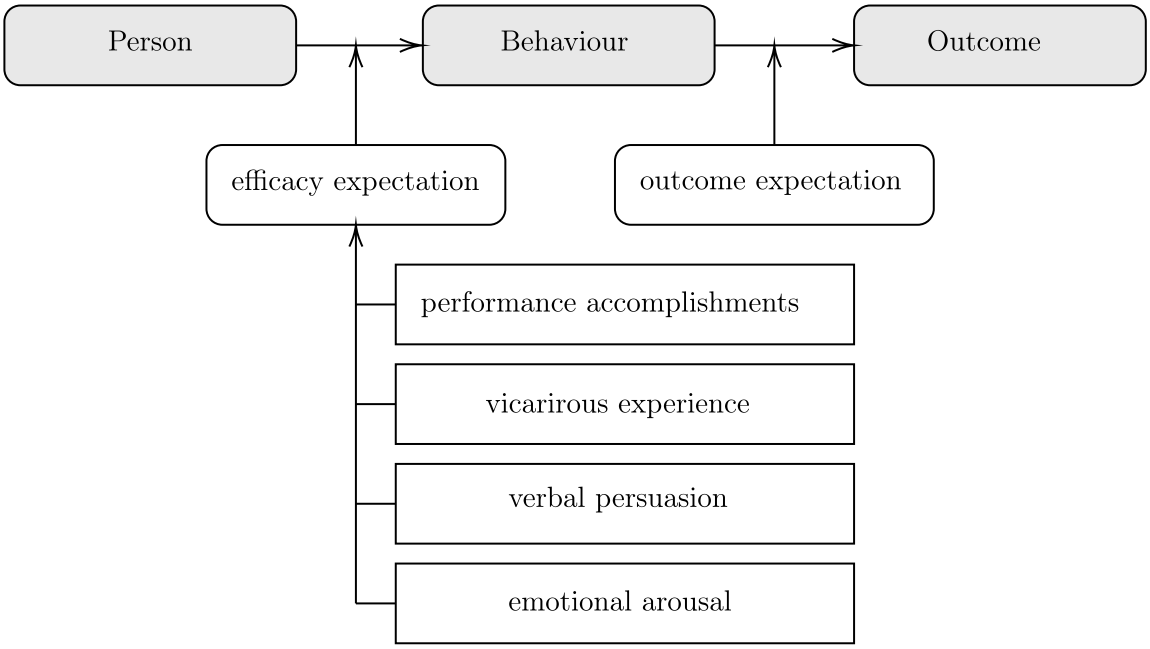
[23] For a comprehensive review of the concept, see Gecas (1989)

[24] Bandura's research focused on the treatment of anxiety disorders. He posited that self-efficacy beliefs where central to behavioral change in patients showing fearful or avoidant behavior.

cessfully execute the behavior required to produce the outcome" (Bandura, 1977a, p.193). This distinction is conceptually relevant. The former is a belief about causal relationships in the environment, whereas the latter is a belief about one's competences. A person may think that a particular act can produce a certain outcome, but at the same time, be convinced that she cannot perform the required action. If that is the case, relevant action may not be initiated, despite full awareness of the appropriate means to achieve the desired outcome. This shows that efficacy expectations are motivationally relevant. They "determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences" (Bandura, 1977a, p. 194). The extent to which efficacy expectations affect behavior depends on the strength and degree of generality of the efficacy expectations as well as the difficulty of the tasks to which they apply. More general and stronger efficacy-expectations have more substantial effects, and are more difficult to overcome than weak expectations that are restricted to very specific tasks (in particular if these are very difficult). In other words: Efficacy-expectations function as self-fulfilling prophecies. In addition to that, they are self-enhancing. Stronger perceived self-efficacy leads to increased effort and perseverance and thereby increases the probability of rewarding experiences of goal attainment. Experiences of success, in turn, strengthen expectations of self-efficacy. Moreover, occasional failures have less impact on efficacy-beliefs once strong self-efficacy expectations have been developed through repeated experiences of success (Bandura, 1977a). In contrast, low self-efficacy expectations induce premature abandonment of tasks and thereby enhance the self-debilitating beliefs. Just like control expectations, expectations of self-efficacy are generalized to a broader set of situations (Bandura, 1977a; Smith, 1989).

Bandura's theory is distinct from other social learning theories (including that of Rotter), in that it stresses the importance of observation and persuasion in learning processes. According to Bandura (1977a), expectations of personal efficacy can be obtained from four different sources: performance accomplishments –i.e., learning from personal experience; vicarious experience –i.e., learning from observing others; verbal persuasion i.e., –learning from listening to others; and physiological states –learning from acknowledging bodily reactions. Bandura's theory was among the first to recognize the latter three as sources of learning. He acknowledges, however, that efficacy-expectations obtained through modeling and verbal persuasion will be weaker and less stable, compared to efficacy expectations that are-obtained from personal experiences (Bandura, 1977a).

Figure 3.1: Bandura's model of self-efficacy



Note: The figure illustrates Bandura's (1977a) concept of self-efficacy and the sources of learning through which it is attained.
Source: Own illustration based on Bandura (1977a).

Although locus of control and self-efficacy are strongly correlated and sometimes even used interchangeably, the concepts are distinct (Judge et al., 2002). While locus of control "is primarily concerned with causal beliefs about action-outcome contingencies " (Bandura, 1977a, p. 204), self-efficacy concerns an individual's evaluations of their capabilities to organize and execute certain courses of action (Bandura, 1986). It is perfectly possible to think that outcomes are contingent on individual behavior, rather than external sources such as powerful others or luck, and to belief at the same time, that one does not have the ability or resources or skills to exert the necessary actions. Bandura (1977a) notes, however, that generalized expectations about the locus of control mediate (and possibly also moderate) the effects of performance attainments of self-efficacy.

3.6.2 Learned helplessness

Another closely related concept is 'learned helplessness'. Learned helplessness results when organisms are repeatedly exposed to uncontrollable events or situations –that is, situations in which outcomes obtain irrespective of individual actions (Maier and Seligman, 1976).[25] Learned helplessness was found to generalize to non-aversivley motivated behavior and to non-traumatic experiences of uncontrollability (Hiroto and Seligman, 1975). When individuals learn that their responses are futile this learning process has motivational, cognitive and emotional effects (Maier and Seligman, 1976). Motivation to take action in averse events occurring afterwards is diminished, and even if action is taken, and it is successful, causal attribution of the outcome to the action is disturbed. Finally, in terms of the emotional consequences, anxiety and depression have been shown to be associated with learned helplessness (Maier and Seligman, 1976).

The relation between learned helplessness and locus of control might be conceptualized as follows: learned helplessness results when internal control expectations are repeatedly frustrated and consequently eradicated. Learned helplessness should therefore be highly correlated with very high external and extremely low internal control beliefs. Indeed the two concepts were found to be related. Hiroto (1974) for example found that initial externality fostered learned helplessness.

3.6.3 Explanatory style

'Explanatory style' emerged from an attributional reformulation of the theory of learned helplessness. The concept circumscribes habitual causal attributions of uncontrollable events (Abramson et al., 1978). According to this reformulation, non-contingency of the environment is attributed to a cause. How individuals react to non-contingency depends on these causal attributions. Causal attributions vary in stability, generality and locus (Abramson et al., 1978): "First, the cause may be something about the person (internal explanation), or it may be something about the situation or circumstances (external explanation). Second, the cause may be a factor that persists across time (stable explanation), or it may be transient (unstable explanation). Third, the cause may affect a variety of outcomes (global explanation), or it may be limited just to the event of concern (specific explanation)." Peterson and Seligman (1984, p. 348). Explanatory style describes a person's characteristic style of offering causal attributions (Peterson and Stunkard, 1992). Research on explanatory styles indicates that more internal, more global and more stable explanatory styles have more detrimental effects on individuals responses towards difficult or challenging situations than when difficult situations are habitually attributed to exter-

[25] The concept was originally discovered for dogs (Overmier and Seligman, 1967; Seligman and Maier, 1967) and later replicated for rats, pigeons and men (Hiroto and Seligman, 1975; Maier and Seligman, 1976).

nal and/or more transient factors (Peterson and Seligman, 1984; Peterson and Stunkard, 1992).

Locus of control captures the internality or externality of such attributions (i.e. beliefs about the first dimensions). But locus of control only refers attributions that are relatively stable and affect a variety of outcomes. Hence, both, internal and external locus of control are two particular explanatory styles - both of which are stable and global.

3.6.4 Summary and evaluation

The concepts above are different from locus of control in various ways. Each of the constructs above was developed as part of an explicit theory designed to explain a particular problem. Self-efficacy aimed to explain behavioral change in the face of anxiety disorders, learned helplessness explains the consequences of being subject to uncontrollable situations. As a consequence, the focus of the concepts above, and their degree of generality differ. Locus of control and explanatory style are more general, whereas self-efficacy expectations were designed to refer to very particular actions. But also the concept that initially referred to very specific actions or situations, such as learned helplessness and self-efficacy, were shown to generalize to a broad range of situations.[26]

At the same time, the concepts share some relevant aspects. All concepts are explicitly cognitive, in the sense that they assign particular relevance to a cognitive, or more precisely, an evaluative process that is generative of certain expectations about the effectiveness of own actions on outcomes. In all of these concepts, these expectations have motivational effects and are postulated as a central determinant of behavior.

Judge et al. (2002) investigated the discriminant and incremental validity of locus of control[27], self-efficacy, self-esteem, and neuroticism.[28] The authors found the four concepts to be strongly related and to have low discriminant validity. For neuroticism, self-esteem

[26]Skinner (1996) developed a useful framework for conceptualizing control-related constructs. Her typology comprises two major distinctions and two minor distinctions. The first major distinction is whether the concept is concerned with actual control, subjective control, or experiences of control. The second distinction is between agents, means, and ends of control. The two minor distinctions concern retrospective vs. prospective control and general vs. specific control. Allocating control concepts in this 4-dimensional space helps to get clarity about their specific content and the differences between concepts. Learned helplessness, for example, focuses on the first distinction and relates a lack of objective control to a subsequently generalized lack of subjective control. While locus of control is concerned with agents of control and based upon perceived control, self-efficacy is concerned with the means of control.

[27]locus of control was measured with the Internality sub-scale of Levenson's (1981) Internal, Powerful Others, and Chance (IPC) Scale.

[28]Self-esteem was taken into the analysis because the authors felt that the view about oneself should be correlated with expectations about one's success. Neuroticism was included because locus of control is sometimes argued to be just a facet of locus of control.

and generalized self-efficacy correlations (ranging from .62 to .85) were comparable to correlations from different measures on the same trait. The correlations involving locus of control were smaller in magnitude, ranging from .40 to .56, thus indicating that locus of control may be somewhat distinct. Nevertheless, principal component analysis of items of the scales of all traits revealed a single factor. A second-order confirmatory factor analysis that allowed the single constructs to load on a higher factor represented a significant improvement in model fit over the first-order model. A study by Leone and Burns (2000) also indicated low discriminant validity between locus of control, self-efficacy, and personal control. Ward (1994) showed low discriminant validity between the locus of control and need for achievement constructs.

In sum, its seems that while all of these measures have a slightly different focus, there is some non-trivial degree of commonality to these concepts. The conclusion that they all measure a general factor that describes individuals' beliefs about their ability to affect specific results in the outer world. It also strengthens the case to take the state of the literature on related constructs into account (while keeping the remaining differences in mind).

3.7 The nature of locus of control - Trait or skill?

Another open question is that of the nature of locus of control. "Because work on control arose from many different theoretical traditions, it has been conceptualized alternatively as a situation-specific perception, an appraisal, an expectation, a generalized expectancy, a causal attribution, an estimate of contingency, an explanatory style, a cognitive construction, a self-system process, and a personality trait" (Skinner, 2017, p. 312). Originally defined as a 'generalized expectancy', locus of control is frequently regarded as a 'trait-like characteristic' and thus treated as an aspect of personality (Heineck and Anger, 2010; Specht et al., 2013; Turnipseed, 2014). More recently, it has become one of the most prominent examples for the group of 'non-cognitive skills' (Cobb-Clark, 2015; Cobb-Clark and Schurer, 2013; Elkins and Schurer, 2017; Heckman et al., 2006). While some do not distinguish between the two, some are keen to make a clear distinction, based on the fact that personality is more stable, while skills are more subject to intervention (Heckman and Kautz, 2013).

The argument that locus of control should be conceptualized as a '*trait-like personality characteristic*' is based on the argument that it is more trait-like than state-like (Wallston, 1992), and that it has *functional properties*, in the sense that it constitutes a predisposition to respond in a certain manner (Turnipseed, 2014) and thus predicts behavioral responses in a relatively stable manner, that holds across situations, thereby complying with conventional definitions of personality (Rotter, 1975; Specht et al., 2013). The empirical evidence on mean-level and rank-order stability indicates, however, that locus of control is less stable than the Big Five (Specht et al., 2011b, 2013).

According to Green's (2013) multidisciplinary framework, skills as personal qualities, which are a) productive of some value b) can be enhanced by training and development, and c) are socially determined. Whether and to what extent locus of control fulfills these criteria is an empirical question. All of these questions will be addressed in the following chapters. A conclusion will be drawn at the end of the thesis.

Chapter 4

Review of the locus of control literature

Locus of control has been and remains to be researched intensely in several disciplines. In 2015 PsychInfo listed over 17,800 articles featuring 'locus of control' as a keyword. The psychological literature on locus of control and related concepts is complemented by increasing interest from other disciplines. This section reviews the parts of this literature that are relevant to this thesis's primary research interest. Section 4.1 aims to provide a rough idea of the importance of locus of control in the production of socio-economic inequality. It focuses on status-relevant outcomes but also touches upon inequality-related outcomes at the individual level that bear political and social relevance. Section 4.2 presents research investigating the association between SEB and locus of control. The Chapter closes by identifying a relevant gap in the locus of control literature that should be of interest to sociologists (Section 4.3): The importance of locus of control in the intergenerational transmission of unequal access to advantage.

4.1 Locus of control in the production of inequality: the association between locus of control and status outcomes

> ... perceptions of internal control, compared to perceptions of external control, are generally found to facilitate: (a) more active search of the environment for information relevant to salient goals, superior cognitive processing and recall of that information, and more incidental as well as intentional reaming; (b) more

> spontaneous engagement in achievement activities, selection of more challenging tasks, and better ability to delay gratification and to persist under difficulty; (c) higher levels of academic and vocational performance and more positive achievement related attitudes; (d) more attempts to prevent and remediate health problems; (e) better interpersonal relationships, more assertiveness toward others, and more liking and respect from others, despite greater resistance to their influence; and (f) better emotional adjustment (higher self-esteem, better sense of humor, less anxiety, less depression, less severe psychiatric diagnoses, etc.) and greater reported life satisfaction and contentment.(Crandall and Crandall, 1983, pp. 53-54)

This almost 40 years-old review leaves little doubt that locus of control must be associated with social status. In the following, the summary by Crandall and Crandall (1983) is completed with more recent research, concentrating on education, the world of work, health and political activity.

4.1.1 Educational choices and attainment

In the domain of education, higher internal and less external locus of control orientations were shown to be positively associated with educational choices and attainment in cross-sectional and longitudinal analyses.

Stronger *internality* has been associated with better achievement test scores and higher grade point averages Grade Point Average (GPA) in high-school (Nowicki and Segal, 1974) and college samples (Aspelmeier et al., 2012) when measured contemporaneously. The association between internal locus of control and GPA is also found when control convictions are measured prior to educational attainment (Flouri, 2006; Heckman et al., 2006; Mendolia and Walker, 2014). Cross-sectional (Baron and Cobb-Clark, 2010) as well as longitudinal studies also indicate that more internal control beliefs are positively associated with the probability of receiving a high-school degree, graduating from college (Coleman and DeLeire, 2003; Heckman et al., 2006) or university (Flouri, 2006). A review by Almlund et al. (2011a) indicates that an increase in internal control convictions by one standard deviation is associated with a 4.5-6.8 percentage point increase in the probability to graduate from high-school. An increase in locus of control and self-esteem from the lowest to the highest decile was found to increase the probability of graduating from college later more than a similar increase in cognitive skills (Heckman et al., 2006). Based on data from the National Education Longitudinal Study (NELS) Coleman and DeLeire (2003, p. 709) find that a "one-standard deviation increase in locus of control is estimated to lead to a 1.6 percentage point increase in the probability of graduating from high school" compared to an increase of 5 percentage points due to a similar increase in math-ability. In a re-estimation of their model using data from the NLSY Cebi (2007) could replicate their results in terms of effect sizes, but the effects were no longer significant.

Stronger *externality* (contemporaneously measured) has been associated with slightly lower GPAs (Aspelmeier et al., 2012). Less external control beliefs, in contrast, were associated with a higher probability of attaining upper-secondary education in a representative sample of Germans Piatek and Pinger (2016). A change from the most external decile to the least external decile increased the probability of attaining an upper-secondary degree by 20 percent. Such dramatic changes are, however, rather rare. More realistic changes of three deciles were associated with a 5 percentage point increase in the probability of attaining upper-secondary education. Wang et al. (1999) found that less externality at 25 is associated with higher years of schooling at 32 in a representative sample for the U.S.

The evidence suggests that stronger internal (lower external) control beliefs are associated with higher educational degrees and better grades. A one standard deviation increase in locus of control is associated with roughly a 5 percent increase in the probability of attaining a school-leaving certificate that provides access to higher education.

4.1.2 Labor-market outcomes and behavior

In the labor market domain, locus of control has been repeatedly associated with employment status, length of unemployment spells, occupational attainment, wages, and other labor-market related outcomes, such as productivity and entrepreneurial spirit. For a comprehensive review of this literature that also discusses potential theoretical mechanisms the reader is referred to the review by Cobb-Clark (2015).

For those*seeking employment*, internality was hypothesized to affect *job-search behavior* positively by increasing the expected pay-off of exerted efforts (Berger et al., 2016; Caliendo et al., 2015; McGee, 2015). In a laboratory study by McGee and McGee (2016) high-internals perceived the association between exerted effort and algorithm-produced job-offers to be stronger than low-internals.[1] They also found that exerted effort was positively related to internality and that internals had higher reservation wages than externals (9.5 percentage points). When the probability of a job offer was not conditional on efforts and, exerted effort and reservation wages were no longer dependent on locus of control.

The results found in the laboratory confirmed evidence based on representative samples of unemployed job-seekers from Germany (Caliendo et al., 2015; Gallo et al., 2003; Uhlendorff, 2004) and the U.S. (McGee, 2015). Caliendo et al. (2015) could show that internal locus of control is positively associated with efforts to get out of unemployment (internals sent on aver 11 percent more applications), higher transition rates from unemployment to work and higher reservation wages. Locus of control has also been associated with the length of other types of labor market inactivity such as return to the labor market after child-birth (Berger and Haywood, 2016) and time spent Not in Employment and Education (NEET) in the transition from school to work (Ng-Knight and Schoon, 2017b). Interventions targeted at re-employment were, also found to be more effective for internals (Berger et al., 2016).

For those *in employment*, internality has been hypothesized to be positively associated with *wages* by operating as an incentive enhancing property (Bowles et al., 2001). Using a representative German panel study (SOEP) Schnitzlein and Stephani (2016) showed that the probability of entering low-wage employment and moving out of it is significantly associated with locus of control. Based on the same data, Heineck and Anger (2010) found that a reduction in external locus of control, which shifts the person from being in the most external quarter to the least external quarter, is associated with a 17 percent wage increase for women and a 20 wage increase for men. For American women, (Groves, 2005) found that a one standard deviation decrease in external locus of control reduces the log hourly wage of women aged about 45 years by over 5 percent. In her study, the effect size of locus of control was comparable to that of cognitive skills and larger than the impact of socio-economic background and work experience. In line with this results, (Heckman et al., 2006)

[1] In their multi-factorial experimental studies, subjects could perform tasks which increased the probability of getting a job offer. In one condition, subjects were not informed about the "relationship between completed tasks and the probability of receiving an offer, while in the certainty treatment they were made aware that each completed task increased the probability of receiving an offer by four percentage points" (McGee and McGee, 2016, p. 90). When an individual accepted a certain job offer (i.e., if the offer exceeded their reservation wage), they would receive the accepted 'wage' for the remaining trials in the experiment.

found that locus of control and self-esteem have about the same effect on wages as cognitive skills. (Cebi, 2007) also found that a 1-SD shift towards internality in youth was associated with a 2.1 percentage point increase in adult wages (as compared to 11.5 percentage points for cognitive ability). Piatek and Pinger (2016), however, found no effects of locus of control on wages, over and above the effects exerted via education. Moreover, externality has been shown to be positively associated with *risk of unemployment* in a representative German sample (Cuesta and Budría, 2017). For internality no such association with risk of unemployment was found in the same data (Gallo et al., 2003).

Evidence collected across various countries and data-sets suggests that locus of control is significantly associated with hourly wages. However, there is considerable agreement about the size of the association, with some studies suggesting that the (non-causal) influence of locus of control is comparable or even larger than that of cognitive skills. Other studies suggest that the influence of locus of control is only a fraction of the influence of cognitive skills. The findings are, however, difficult to compare, as different measures of locus of control have been used, and some studies were conducted several decades ahead of others, and the importance of locus of control may in determining income may have changed across time.

Locus of control has also been associated with *occupational class*(Breen, 2001; Wang et al., 1999).[2] In the study by Wang et al. (1999) the effect of internal locus of control on occupational class was almost double the size of the effect of cognitive abilities.

Further associations have been found between locus of control and entrepreneurial spirit (Baluku et al., 2018), entrepreneurial opportunity recognition (Asante and Affum-Osei, 2019), self-employment (Caliendo et al., 2014). Self-employed were found more internal than employees, and employees were more internal than not-working individuals (Caliendo et al., 2014). At the same time, the self-employed were least external, whereas the non-working were most external. "[A]n increase in internal (external) locus of control by one standard deviation raises (lowers) the self-employment probability by 1.36 (1.0) percentage points, which corresponds to a relative effect of 15.6 percent (-11.4 percent)" (Caliendo et al., 2014, p. 802). Additionally, locus of control has also been related to

[2] Occupational class was measured close to the U.S. Department of Labor classification in the following eight categories: laborers and farmers, operatives, services, clerical, craftsman, sales, managers and administrators, and professionals and technicians

investment in training (Caliendo et al., 2020) and greater job motivation and other-rated task-performance (Ng et al., 2006).

Taken together, more internal individuals have been found to earn higher hourly wages, obtain higher occupational classes, be more likely to recognize entrepreneurial opportunities, and to be self-employed. For more external individuals the reverse seems to be true.

4.1.3 Health and selected individual outcomes of societal relevance

Locus of Control has been found to be associated with further individual outcomes and behaviors that bear societal relevance. This section briefly touches upon a selection thereof.

One domain of individual outcomes that bears great societal relevance is individual health and subsequent healthcare utilization and time of recovery. A large body of literature has associated locus of control with *mental and physical health*, mortality, and risk behavior. Studies on representative samples of the population in the U.K., Australia, and Germany show that more internal locus of control is associated with better self-reported physical and mental health (Gale et al., 2008; Kesavayuth et al., 2020), lower risk of disability and mortality (Infurna et al., 2011), lower usage of preventive and curative healthcare (Kesavayuth et al., 2020), and faster return to the labor market following health-shocks (Schurer, 2017). Kesavayuth et al. (2020) for example, showed for a representative sample of Australians that individuals who are one SD more internal than the average report better physical (0.25 SDs) and mental (0.32 SDs) health, and are 5.7 percentage points less likely to have long term health condition. The effect of a 1 SD increase in internality was about 1.8 to 2.4 times higher than the differences in physical and mental health between employed and not-working individuals. According to an investigation by Infurna et al. (2011) based on SOEP data a one SD increase in internality was associated with a decrease in the risk of death in the next 14 years of 4 percentage points independent of socio-economic and psycho-social factors.

The protective function of internal locus of control beliefs might be due to a variety of *behavioral differences* between internals and externals. Fore example, internals have been shown to invest in their social life, spend more time outdoors, exercise more, follow healthier diets, smoke less, and suffer less often from obesity and overweight (Cobb-Clark et al., 2014; Gale et al., 2008; Heckman et al., 2006; Kesavayuth et al., 2020). While greater internality appears to be associated with a variety of healthy lifestyles, drinking appears to be an exception: Studies on representative samples of Germans (Caliendo and Hennecke, 2020) and Australians (Cobb-Clark et al., 2014; Kesavayuth et al., 2020) indicate that internality is positively associated with moderate but regular drinking. A potential explanation for this may be the greater sociability of internals.

As a consequence of their better health, internals also *use less healthcare and are less absent from work*. Kesavayuth et al. (2020) report that a shift towards internality by 1 SD reduced the number of doctor visits in the last year by 0.12 standard deviations. The probability of being hospitalized was reduced by one percentage point. For Germany Hajek and König (2017) found that only changes in external locus of control were associated with changes in the number of doctoral visits. In contrast, changes in internal locus of control were not associated with differences in doctoral visits. Based on SOEP data Schurer (2017) found that internals bounce back from health shocks faster and more fully than externals. Internals worked on average 12 percent more hours per week and were 100 percent less likely to drop out of the labor market in the year following a negative health shock than externals. Internal locus of control has also been shown to have positive effects on psychological well-being after serious injuries or illnesses Buddelmeyer and Powdthavee (2016), and even in terminally ill cancer patients (Brown et al., 2017).

Hence, internality not only protects against health shocks, but it also may function as a *resilience* factor when they obtain. Locus of control also seems to foster psychological resilience to other shocks, such as becoming a victim of physical violence Buddelmeyer and Powdthavee (2016). However, for some shocks, especially when not oneself but close friends or relatives are concerned, greater internality does not seem to improve psychological coping (Buddelmeyer and Powdthavee, 2016). Specht et al. (2011a) even show that widows' life-satisfaction recovered faster if they had more external control beliefs. While this implies that more internality is not always better, it shows the importance of the general locus of control orientation.

Delinquency and criminal activity is another domain of life, which has been shown to be associated with generalized control expectations. According to the review by Almlund et al. (2011a) locus of control explains between 10 and 16 percent of contemporaneously measured drug use, theft, and vandalism. Cunha et al. (2010) found that a shift from the lowest to the highest decile of the distribution of internal locus of control and self-esteem significantly reduces the probability of incarceration for men, while a similar change in cognitive skills has only a very small effect on the probability of incarceration.

In addition to the topics above, locus of control has been associated with *political participation and activism* (Deutchman, 1985; Gore and Rotter, 1963; Levenson, 1974; Rosen and Salling, 1971), pro-environmental attitudes and behavior (Guagnano, 1995; Huebner and Lipsey, 1981; Pavalache-Ilie and Unianu, 2012) and the propensity to provide first aid (Bierhoff et al., 1991). Hence locus of control is associated with domains of life that may incur costs but also benefits to society as a whole.

Educational and occupational outcomes, but also health, delinquency, and political participation are major dimensions and determinants of social inequality. Since all of these domains appear to be associated with locus of control, locus of control can be considered one of the variables that underlay socio-economic inequality as a whole.

4.2 Reproduction of social inequality: the association between socio-economic background and locus of control

If locus of control is such an important determinant of social status, to what extent is it determined itself by the individual's initial position within society? To the degree that locus of control depends on the initial position of a person within the social distribution, their chances for attaining valued goods, such as education, income, good health, political voice, and greater resilience to negative shocks would be unequal. This section reviews evidence on whether there is a social gradient in locus of control. Potential explanations for such a gradient will be discussed in the next Chapter.

Social class differences in locus of control have been shown to manifest early in life and persist into adulthood. While most studies that demonstrate social class differences in children's locus of control focus on middle-childhood, there is some evidence that the social divide in locus of control opens up in early childhood. Stephens and Delys (1973) analyzed toddlers' responses to questions such as 'What makes your mother smile?' to gain information about their generalized control expectations. The responses of the two-to-four-year-olds from disadvantaged backgrounds indicated more external control beliefs than the answers of their middle-class peers[3] Stephen's and Dely's (1973) findings contrasted earlier findings by Bartel (1971) according to which social class differences emerged in middle childhood around the ages of ten to twelve. Bartel (1971) administered Bialer's (1961) children's locus of control measure to 431 middle and lower class children in grades 1, 2, 4, and 6. For children in the first and second grades, no significant class difference was found. For children in fourth and sixth grade, significant differences were found: In the higher grades, middle-class children were significantly more internal than lower-class children. Comparisons across the age-range indicated that the social-class difference is due to different developmental patterns: Middle-class children grow more internal in middle childhood but lower-class children don't. Bartel (1971) also found that the social class differences in control convictions could be explained by differences in cognitive abilities between the two. This highlights the importance of controlling for cognitive skills when analyzing locus of control in the context of social class.

Based on a small sample of 80 lower and middle-class children in sixths and eights grade Battle and Rotter (1963) found lower-class children to be more external than their peers from middle-class families. In this study, Battle and Rotter's (1963) Children's Picture Test of Internality-Externality was used to measure locus of control.[4] In this test, children are encouraged to recount what happened in a set of situations that are depicted in small drawings. Crandall et al. (1965) confirmed their findings in a larger sample of 923 children from third to twelfth grade, using the same test. Nowicki and Strickland (1973) also find significant correlations of social background with children's locus of control for third to tenth graders when locus of control is measured with the CNS-IE scale.

The results of these relatively small studies from the early days of locus of control research have been replicated more recently in larger, representative samples. For middle

[3]The group of disadvantaged children was sampled from Head Start classes. Children growing up in families with income levels below the poverty line or receiving social benefits, as well as children from foster homes, were eligible for the Head Start Program. The middle-class children were recruited from Montessori preschools and parent-Coop Nurseries. Locus of control orientation was measured by interviews, which included questions such as "What makes your Mother smile?" with the object of the question varying between parents, teachers, other children, and the self.

[4]Black children from low background were found to be most external. They also find that externality is more pronounced for those from disadvantaged backgrounds with high levels of IQ. While cautioning over-interpretation of their results, which are based on only 80 observations, they hypothesize that the adoption of external control beliefs is used as a strategy of self-defense in the face of restricted opportunities to obtain positions of advantage in society.

childhood, there are three studies based upon the 1970s British Cohort Study that demonstrates that different indicators of social status predict locus of control at the age of 10 (Elkins and Schurer, 2020; Flouri, 2006; Wickline et al., 2011). Based on the same data, von Stumm et al. (2009), found, however, that locus of control measured at the age of ten is more strongly related to intelligence and mother's and teacher's ratings of behavior than to parental social class. Golding et al. (2017) confirmed the association between parental education and children's locus of control for a sample of children born between 1990 and 1992 in the area of Bristol. Using another representative sample of U.K. children born 30 years later (the Millennium Cohort Study), Ng-Knight and Schoon (2017b) no longer find an association between parental social status and children's locus of control. The difference in findings might be a cohort effect. Shane and Heckhausen (2017) report that among current cohorts, internal locus of control is consistently found to be high regardless of socioeconomic background.

For adolescents, the evidence is somewhat more diverse. Lewis et al. (1999) finds for NLSY data that parental education is positively associated with internal locus of control in teenage years and young adulthood (14-22), while household income plays no role. Using the same data Goldsmith et al. (1996) found no significant effects of parental education or the presence of reading material in the household on locus of control. Baron and Cobb-Clark (2010) also found no significant relationship between family welfare history and the locus of control orientation of eighteen-year-old Australians. Males internality was however affected significantly by parental occupational status. For a representative sample of seventeen-year-old Germans Anger (2012) finds that adolescent children of highly educated parents reported significantly lower external control beliefs than children of parents with a low level of education. For internal locus of control, no social gradient was found for the adolescents.

In sum, the evidence suggests that it is in particular parents' educational and occupational attainments that matter for children's locus of control orientation., while income seems to be less relevant.

The association between social background and locus of control in childhood is also found for adults. Various studies confirm that internal (external) locus of control in adulthood is positively (negatively) associated with socioeconomic background and parental education and occupation in particular (Elkins and Schurer, 2020; Golding et al., 2017; Lewis et al., 1999; Schurer et al., 2014). A longitudinal study by Lewis et al. (1999) based on NLSY data indicates that individuals with more highly educated parents experience a steeper increase in internality between adolescence and adulthood. The evidence is, however, not unequivocal. In contrast to what would be expected Anger (2012) found a negative correlation between parental educational level and adult children's internal locus of control. External control was negatively correlated with parental control, as expected, but the correlation was no longer significant once parental locus of control was controlled for.

Altogether the evidence indicates a significant association between parental social status and children's locus of control orientation. The majority of the findings indicate that higher parental educational level and occupational status are associated with stronger internality and less externality. Combining this with the evidence on the association between locus of control and various life-outcomes indicates, that locus of control may play a significant role in social status transition.

4.3 Connecting these strands of literature: a case for sociological inquiry and a gap in the literature

So far, the strands of research laid out above remained unconnected. One strand of research considered locus of control as an outcome variable, trying to explain how differences in locus of control come about, without paying too much attention to its consequences. The other strand of research utilizes locus of control as an explanatory variable for various outcomes, without worrying too much about how these beliefs were obtained. This strand of research treats locus of control as if it existed in a social (and biological) vacuum.

Neither locus of control nor its consequences exist in a social vacuum, however. Locus of control is formed by generalizing experiences of contingency. These experiences are shaped by a persons social and ecological environment . This environment includes different spheres of social and ecological influences (Bronfenbrenner, 1995). These spheres range from the most proximal relationships of a person, to the general structure of society and implicit belief systems and ideologies that structure the major institutional settings within society (see Section 2.2.1). At the same time, locus of control itself acts to shape the social and ecological environment of individuals.

Locus of control is thus both, a structured structure, and a structuring structure, in the sense of Bourdieu (1984). As such, it may act to reproduce social inequality. In this role, as a mediating variable in the intergenerational transmission of social status locus of control should of primary interest to sociologists. Unfortunately such a genuinely sociological perspective on the locus of control construct is largely missing in the current locus of control literature. The aim of this Thesis is to add work that is inspired by a sociological perspective to the current locus of control literature. Towards this end, it explicates the role that locus of control may play in the process of status reproduction, and it investigates the potential which locus of control may offer for improving equal access to advantage.

Chapter 5

Integrating theory: Locus of control in the reproduction of social inequality

"The stresses, uncertainties, and low social standing connected to low-SES bring about a sense of powerlessness, low self-esteem, learned helplessness, and reduced orientation toward mastery and efficacy"
(Bradley and Corwyn, 2002, p. 384).

This Chapter draws on existing theoretical and empirical work to establish a theory of the role of locus of control in the reproduction of social inequality across generations. The first section establishes the role that locus of control plays in predicting behavior. This section is relevant to explain why locus of control has been associated with so many desirable outcomes. The second section takes an intragenerational perspective and discusses how a person's position within society affects her locus of control and how certain psychological mechanisms may exacerbate this effect. The third section adopts an intergenerational perspective and portrays how locus of control is transmitted from one generation to the next and how this process is socially structured. In each Section, theoretical arguments are presented first, followed by a short discussion of related empirical evidence. The last section unites the elements of the theory and reflects on their societal consequences. Figure 5.2 provides a useful overview over the respective mechanisms.

5.1 The function of locus of control in predicting behavior

Why is locus of control so robustly associated with such a variety of desirable outcomes as Chapter 4 has shown? A first step towards understanding the function of locus of control in the reproduction of social inequality across generations is to understand why locus of control is associated with status relevant outcomes. This section traces in detail how and why locus of control is associated with achievement-related behavior and choices.

Towards this end, it makes sense to go back to the origins of the locus of control concept: Rotter's (1954) social learning theory. Rotter's (1954) social learning theory departs from the behaviorist tradition in stressing the *importance of the social environment* for learning processes. The effectiveness of a particular reinforcement is hypothesized to depend on the degree to which the individual perceives the reinforcement as conditional on her behavior and the value the individual attaches to the reinforcement. Adding these two elements to simple behavioral stimulus-response theories, Rotter could explain why individuals deviate from the behavior that would have been expected given a particular reinforcement schedule.[1] On this basis, Rotter (1954, p. 108) formulated a general formula for behavior, which states that:

> "The potential for behavior X to occur in situation 1 in relation to reinforcement A is a function of the expectancy of the occurrence of reinforcement a following behavior X in situation 1 and the value of reinforcement A"[2]

Moving away from psychological parlance one could replace *reinforcement* with *outcome*. Rotter's social learning theory thus holds that individual differences in behavior in relation to some outcome are explained by (a) the expectancy of a certain behavior leading to a certain outcome and (b) the value that is attached to that particular outcome by the individual. Locus of control refers to this first part. Locus of control is a measure of

[1] A reinforcement schedule is a plan of reinforcements that are applied in order for an organism to 'learn' a certain behavior. It is a tool that was frequently used in traditional behaviorist research. For example, every (other, third, fourth) time a desired reaction is shown, it would be reinforced by some positive reaction towards it. This allowed studying how learning depends on reinforcements.

[2] Rotter (1954) then generalizes this statement further to include a set of behaviors (x-n) that are evicted in a set of situations (1-n) in response to a set of reinforcements (a-n). The formula then reads. "The potentiality of the functionally related behaviors x to n to occur in the specified Situations 1 to n in relation to potential reinforcements a to n is a function of the expectancies of these behaviors leading to these reinforcements in these situations and the values of these reinforcements in these situations" (Rotter, 1954, p. 110). The central idea which is relevant to the present argument is, however, already ostensible in the more specific formulation stated above.

the *generalized expectancy about the degree to which outcomes are contingent on individual behavior*. The quote illustrates that Rotter's social learning theory is part of the family of expectancy-value theories (Skinner et al., 1998). Expectancy-value theories maintain that whether a person chooses to pursue a respective outcome and the amount of effort exerted in doing so depend on the subjective value attributed to that particular outcome and the expectation of succeeding in this endeavor (Eccles and Wigfield, 2002).

Later theoretical accounts differentiated these expectations of success further (Bandura, 1977a; Skinner, 1996; Skinner et al., 1988). Bandura (1977a, p. 194), for example, pointed out that "expectation alone will not produce desired performance if the component capabilities are lacking". Bandura therefore differentiated between efficacy expectations and outcome expectations.[3] Locus of control does not distinguish systematically between these two convictions. This distinction may, however, be relevant for explaining individual and social class differences in goal-related behavior. Skinner (1995, 1996) suggested a conceptualization of control that integrates Rotter's and Bandura's theoretical accounts. Skinner's (1988) conceptualization differentiates means-ends (or strategy) beliefs from agency beliefs and control beliefs. Means-ends (or strategy) beliefs concern the expectation that particular causes produce certain outcomes. Agency beliefs refer to the expectation to have access to the means needed to produce a particular outcome. Control beliefs finally refer to a person's beliefs about their general ability to affect certain outcomes, irrespective of the means. Locus of control is most closely related to these more general control beliefs. Agency beliefs are more aligned with Bandura's efficacy. Skinner's (1988) conceptualization of control, can be used to analyze the function that locus of control plays in determining behavior.

In a rational choice framework, locus of control, or control beliefs could be interpreted as the level of uncertainty with which a certain action, or effort, leads to the desired outcome.

External control beliefs are a source of friction in the motivational process. The amount of effort that a rational agent would exert is expected to decrease with the degree of uncertainty attached to the association between the exerted effort and the occurrence of the

[3]Efficacy expectations are convictions about one's own capacities to perform the required actions to produce an outcome. Outcome expectations are convictions about whether particular actions lead to the desired outcome (see Section 3.6).

Table 5.1: An explication of control concepts according to Skinner (1988)

Means-ends beliefs, Strategy Beliefs	
Belief	To attain Z, X is necessary.
Corresponding Question	“ ***What*** does it take to attain Z?”
Example	If you want to run a marathon, you need to train for it.
Corresponding Concept	Bandura’s outcome expectations
Agency beliefs	
Belief	I have the capacity to do X.
Corresponding Question	“Do ***I*** have what it takes to do Z?”
Example	I cannot run a marathon, because I don’t have legs.
Corresponding Concept	Bandura’s self-efficacy
Control Beliefs	
Belief	In general it is possible to attain Z.
Corresponding Question	“Can Z ***in general*** be controlled?”
Example	Your level of fitness can be controlled ...
	but not the weather on the day of the marathon.
Corresponding Concept	Rotter’s locus of control

Note: The table explicates the elements of Skinner’s (1988) conceptualization of control and relates them to Bandura’s concept of self-efficacy and Rotter’s locus of control concepts.

desired outcome. This also holds if the uncertainty is only subjective. Even before the concept of locus of control had been spelled out, Merton (1946, cited in Rotter, 1966, p. 3) contended that a belief in luck “may (...) act to curtail sustained endeavor”. Hence externality is expected to dampen purposeful activity and effort. Tragically this attenuating effect maintains its influence even in the presence of agency and means-ends beliefs. An illustrative example may be helpful: A young immigrant may be aware that a good education is required to obtain a specific type of job (means-ends belief). Moreover, they may think that they have what it takes to obtain that kind of education (agency belief). If the same person thinks, however, that obtaining that education would not get them any closer towards getting the desired job because of discrimination against immigrants on the job market (external control belief), they may opt not to pursue the required education. Similar examples could be constructed where externality is introduced by luck and fate. Externality is detrimental to motivation, regardless of whether it is justified or not.

Internal control beliefs, in contrast, indicate a stronger perceived association between effort and outcomes and thus set the stage for purposeful action. Note, however, that internality itself does not necessarily imply purposeful action since, in addition to internal control beliefs, agency beliefs and strategy beliefs are necessary, as Bandura (1977a) and Skinner (1995) point out. As these arguments apply irrespective of the content of the outcome, it becomes clear why locus of control has been associated with such a broad variety of outcomes. The arguments made above thus suggests the following:[4]

> ***Proposition I:*** *Internality is necessary, but not sufficient to motivate effort, while externality is sufficient, but not necessary to prevent action or diminish effort.*
>
> ***Proposition II:*** *Due to this difference in the causal function, the causal effect of internality and externality on choices of effort are expected to be asymmetric. Externality is predicted to be more detrimental to effort and investment than internality is conducive to it.*

In this context, the *dimensionality of locus of control* becomes theoretically important. When locus of control is understood to be a bi-dimensional construct, one dimension - externality - would be predicted to have a greater impact on outcomes, as it suffices to attenuate efforts. The other dimension - internality - does not suffice to induce effort. Albeit sufficient, externality is at the same time not necessary to attenuate effort because a lack of subjective valuation for the outcome may have the same effect. This difference between internality and externality in the logical relation to outcomes might be put forward as *a theoretically derived argument to consider locus of control a bi-dimensional construct.* In the case of a uni-dimensional conception of locus of control, the theoretical reflections above would imply non-linear effects of locus of control: Changes at the internal end of the distribution would be predicted to have less of an impact than changes on the external end of the distribution.

In line with the argument above are two theories that explicate the association between locus of control and educational investments (Coleman and DeLeire, 2003)[5] and wages (Bowles et al., 2001).[6] In both theories, locus of control is hypothesized to mod-

[4]While an empirical test of the propositions formulated in this chapter is undoubtedly necessary and interesting, it does not form part of this dissertation. The main reason for this is that these propositions have been developed throughout the dissertation and should be considered an outcome of the work rather than its starting point.

[5]Coleman and DeLeire (2003) integrate locus of control into a Beckerian (1994) human capital investment model. Their model does not assume any association between locus of control and labor market productivity. In their model, locus of control is assumed to affect perceptions of the returns to education (i.e., expected income paths), where more internal (external) locus of control affects perceived educational returns positively (negatively). As a consequence, individuals with more internal (external) control beliefs are more (less) likely to invest more in education.

[6]The theoretical exploration of Bowles et al. (2001) starts off acknowledging that the employment relationship is contractually incomplete: While wages are fixed and can be enforced, the employee's efforts are often not fixed and harder to control and enforce. In other words: employees' efforts are endogenous. Bowles et al. (2001) postulate that in such a situation, employers may choose to pay for preferences or

ulate perceived return to effort and investments in the future.[7] Given equal incentives (i.e., equal valuation of the outcome), more internal individuals are expected to exert more effort because internality increases the expected return to effort. Bowles et al. (2001) coined the term *incentive enhancing properties* to describe any attitudes or personality characteristics that lead their bearers to exert more effort keeping everything else constant. The authors explicitly name locus of control as one of these characteristics. In line with this reasoning, an experimental study by Borghans et al. (2008) demonstrated that internals are less responsive to financial incentives when allocating effort to cognitive tasks.

The arguments above explain the association between locus of control and the great variety of outcomes that were discussed in the literature review in Chapter 4. Locus of control affects effort by moderating the expected return to effort (holding the value of the outcome constant).[8] What remains to be explained is why individuals from different social strata differ in their locus of control and how this difference reproduces social inequality, both within one generation and across generations.

personality characteristics that allow the employers to elicit effort at a lower cost. These are characteristics, which will cause employees to work harder when all other things such as working conditions and wages are kept equal. Locus of control is suggested as one such characteristic. More internal individuals are expected to exert greater effort, as they perceive outcomes to be more dependent on their actions. Bowles et al. (2001, p. 1145) also points out that “[t]he value of incentive-enhancing preferences will vary with the nature of the endogenous enforcement problem. Where monitoring is impossible, for example, the importance of truth-telling might be heightened”.

[7]Note that the concept of return to effort depends on both, expectations of success as well as the valuation of a particular outcome

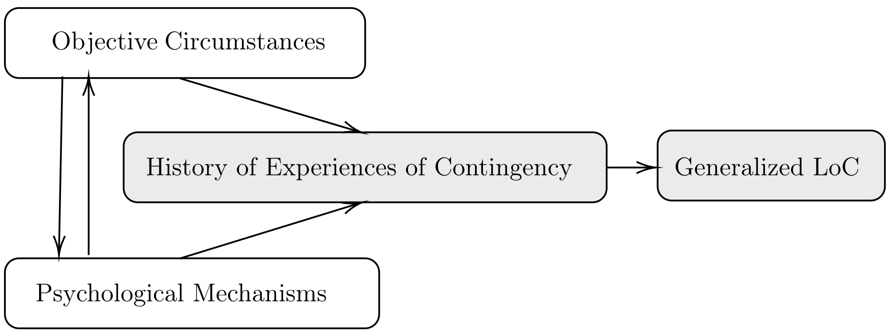
[8]The latest wave of locus of control research mainly has focused on explaining individual differences in behavior by focusing on differences in control beliefs, frequently ignoring differences in the value that is attached to a specific outcome. Rotter (1975, p. 59) himself has lamented that “[the] most frequent conceptual problem (...) is the failure to treat reinforcement value as a separate variable. To make a locus of control prediction, one must either control reinforcement value or measure it and systematically take it into account." Adding a more sociological perspective to the locus of control concept requires showing how both elements, control beliefs, and reinforcement value are affected by the social structure and the person's situation within it. A considerable body of sociological research establishes how reinforcement value, i.e., the value of certain attainments and outcomes, differs by social class (Boudon, 1974; Bourdieu, 1977; Jencks, 1979; Katz and Katz, 1964; Kohn and Schooler, 1969; Sewell et al., 1957). These are not discussed here.

5.2 Intragenerational socio-economic influences on locus of control

This section focuses on intragenerational influences of the social environment on a person's locus of control orientations and the psychological mechanisms activated in response to these external influences. The argument builds upon sociological and psychological theories that aim to explain social-class differences in perceived control. (Evidence for these differences is provided in Section 4.2)

A number of theories have been put forward to explicate social class differences in locus of control (Merton, 1946; Mirowsky and Ross, 1990a; Wheaton, 1980).[9] These theories share a common ground (illustrated in Figure 5.1). They all suggest that social class differences in locus of control arise because the history of experiences from which locus of control is formed is determined by the position of the person within society. The theories depart from Rotter's original social learning theory in that the interpretation and generalization of these experiences are not considered free of bias. Instead, it has been hypothesized that a number of psychological mechanisms intervene in these processes. The bias that is introduced through these psychological mechanisms is assumed to incur some sort of benefit to the individual. Social-class differences in locus of control may thus be due to differences in objective circumstances and differences in the interpretation of experiences (affected by the psychological mechanisms).

Figure 5.1: Common elements of theories explaining social-class differences in LoC



Note: The figure illustrates the common ground of the theories that aim to explain social class differences in locus of control

Source: Own illustration based on Mirowsky and Ross (1990a).

[9]Mirowsky and Ross (1990a) provide a good overview over the development of these theories.

5.2.1 Definition of socio-economic group and socio-economic status

Before looking into how the objective circumstances that are associated with a particular position in society give rise to different histories of experiences, it makes sense to clarify the meaning of *socio-economic group* and *socio-economic status (SES)* that is employed here. Socio-economic groups are understood here as sets of individuals with a comparative set of resources. The set of resources is comparable in the sense that it is equally potent in providing access to certain goods and privileges. Socio-economic status is defined by the set of resources that is available to the person. A higher set of resources indicate a higher socio-economic status. The conception of socio-economic status employed here is closely aligned with Bourdieu's (1985) understanding of social class.[10] Bourdieu's understanding of social class is explained in more detail below to provide a more comprehensive idea of this thesis' conception of social class.

According to Bourdieu, social classes, are sets of agents who occupy similar positions in the social space. The position of an individual within the social space,[11] and thus their socio-economic status is defined by the positions they occupy in the distribution of the powers that are active within the different social fields in which they are immersed (Bourdieu, 1985). The position in the distribution of powers is defined by the overall amount of capital possessed by the individual and the relative weight of the different kinds of capital (Bourdieu, 1985). Bourdieu (1985) distinguishes four kinds of capital: economic, social, cultural, and symbolic. *Economic capital* includes all forms of economic resources such as income, wealth, and property. *Social capital* is "the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutional relationships of mutual acquaintance and recognition (Bourdieu and Wacquant, 1992, p. 119). *Cultural capital*, in its most general sense, captures familiarity with the dominant culture in a society (Jaeger and Breen, 2016). An often-cited clarification of the term by Lamont and Lareau (1988, p. 156) defines cultural capital as "widely shared, high-status cultural signals (attitudes, preferences, formal knowledge, behaviors, goods and credentials) used for social and cultural exclusion". Cultural capital is distinguished further into a) institutionalized cultural capital, b) incorporated cultural capital,

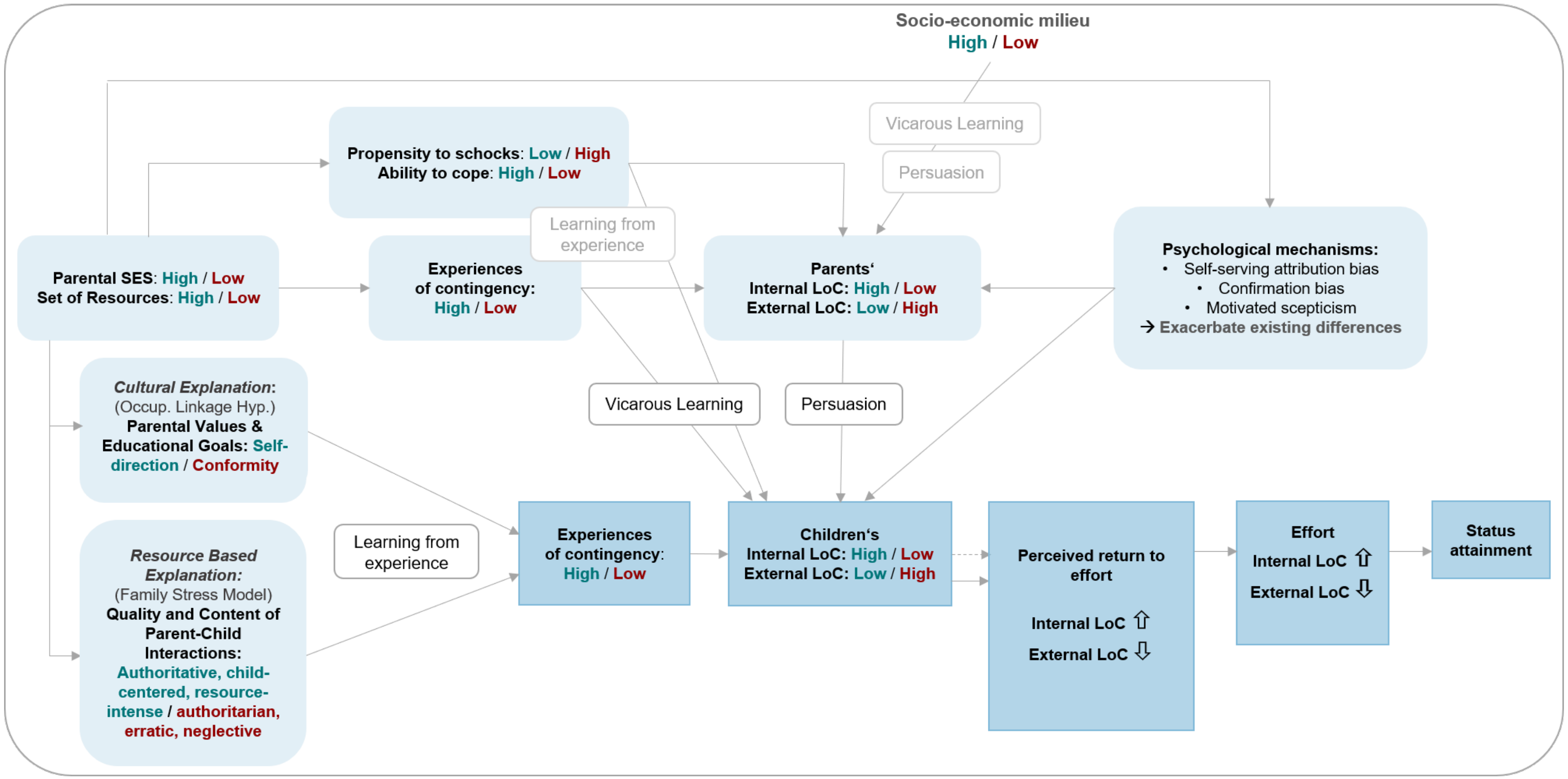
[10] Bourdieu's (1985) differentiates his class concept ('classes on paper') from the Marxian class concept, which conceptualizes classes as conscious group mobilized for struggle. He admits, however, that these theoretical classes might 'probable classes', as they could be mobilized more easily than other sets of agents (i.e., agents from different classes).

[11] The social space comprises different social fields.

and c) objectified cultural capital. Institutionalized cultural capital includes all forms of capital that are institutionalized, such as educational titles. Incorporated cultural capital includes all types of knowledge and skill that a person has acquired. It is 'incorporated' because it cannot be easily handed on to another person. Becker (1994) refers to this set of skills and knowledge as *human capital*. Objectified cultural capital are cultural goods (objects) that can be handed on to others easily. Examples of objectified cultural capital are books, pieces of art, instruments, etc.. All forms of capital can be transferred into one another, and they can be invested to generate more capital and to promote one's position (Bourdieu, 1985). Inequalities in one form of capital are thus likely to be associated with inequalities in other capital forms.

Bourdieu's classes are not only characterized by a shared set of resources but also by a shared system of values, taste, and perceptions. "[B]eing placed in similar conditions and subjected to similar conditionings, [sets of agents who occupy similar positions] have every likelihood of having similar dispositions and interests and therefore of producing similar practices and adopting similar stances" (Bourdieu, 1985, p. 725). This shared culture is what Bourdieu (1984) termed the *habitus*. According to (Bourdieu, 1984), this habitus acts as a tool of distinction between social classes. While the habitus of the higher classes is chosen to distance themselves from lower social classes, the lower class's habitus is not a product of free choice. It is rather the product of the objective circumstances to which the lower class is subjected. An "amor fati, the choice of destiny, but a forced choice, produced by the conditions of existence which rule out all alternatives as mere daydreams and leave no choice but the taste for the necessary" as Bourdieu (1979, p. 178) famously put it. Locus of control can be considered to be an element of the habitus. The observed social class differences in locus of control may be a product of this *amor fati* for those holding low positions in society. The remainder of the Chapter may clarify whether such a conceptualization of locus of control seems warranted.

Figure 5.2: Graphical representation of the theoretical framework



Note: The figure illustrates the theoretical mechanisms and paths through which locus of control contributes to the reproduction of socio-economic status from one generation to the next. Lighter colors are for the first (parental) generation, darker colors illustrate mechanisms in the second (i.e., the children's) generation.
Source: Own illustration.

5.2.2 Differences in objective circumstances and their effect of experiences of contingency

Rooted in a Marxist tradition, the sociological literature that connects individual's social class position to their locus of control typically assumes that individuals from higher socio-economic groups *actually have* more control over their outcomes, while individuals from lower social classes *actually lack* opportunities and means to exert control over their outcomes (Pearlin and Radabaugh, 1976; Ross and Mirowsky, 1989; Wheaton, 1980).[12]

> "[P]erceived control is seen as a relatively accurate assessment of an individual's ability to control life circumstances and to respond to stressful events. It is suggested that the constraints faced by those with low-SES and heavy role responsibilities will lead to a reduction in the actual amount of control one does have over life circumstances (...). Not only do scarce resources limit one's life options, but perceived control can also be eroded by the insecurity of knowing that resources are not available should they be needed for emergencies or daily difficulties (Bullers and Prescott, 2001, pp. 147 - 148).

A detailed explication of the mechanisms through which social class affects the history of experiences of contingency is, however, lacking. This section complements this body of literature by spelling out how differential access to resources may affect the history of experiences of contingency.

Existing attempts typically ascribed a central role in this mechanism to the occupational realm. Bradley and Corwyn (2002, p. 383) point out that "[t]he chronic strain associated with unstable employment and persistent economic hardship can lead to diminished self-esteem, a diminished sense of control over one's life, anger, and depression". Ross and Mirowsky (1989) traced feelings of powerlessness back to the inability to achieve one's ends, an insufficient stock of capital, a lack of alternatives, and restricted autonomy at work. Gecas (1989, p. 304) concludes a review of several studies from the 1970s and 1980s saying that "it is evident (...) that occupational conditions that enable efficacious action are conducive to the development of self-efficacy".

[12]The scarce sociological research in social-class differences in locus of control that exists is rooted in the Marxist tradition and in particular in his reflections on the sources of alienation. The association between the concept of alienation and locus of control was certainly facilitated by Seeman's (1959) conceptualization of alienation as powerlessness, which is closely aligned to Rotter's definition of locus of control as the "expectancy or probability held by the individual that his own behavior cannot determine the occurrence of outcomes or reinforcements he seeks"(Seeman, 1959, p. 784).

Over a series of articles, Melvin Kohn and his colleagues worked out how specific job characteristics (which are typically related to certain occupations and thus social class) affect the valuation of self-direction and other concepts more or less closely related to locus of control (Kohn, 1989; Kohn and Schooler, 1969, 1973, 1983). Pearlin and Kohn (1966, p. 466) hypothesized that "self-direction seems more possible and more necessary in middle-class occupations; working-class occupations allow much less room for, and in fact, may penalize, anything other than obedience to rules and directives set down by others". They found that job-characteristics could explain roughly 40 percent of the association between social class and locus of control (Pearlin and Radabaugh, 1976).[13] Based on the same data, Kohn (1976) could relate feelings of powerlessness to the degree of self-direction, the closeness of supervision, and the substantive complexity of work.

It seems that the entire employment situation is relevant to a person's control orientation. Involuntary experiences of unemployment have been associated with decreases in feelings of mastery (Pearlin et al., 1981) and internal locus of control (Buengeler and Biemann, 2018; Goldsmith et al., 1996; Patton and Noller, 1984; Tiggemann and Winefield, 1984; Winefield et al., 1991) in longitudinal data. More recent longitudinal data analyses indicate that unemployment induced changes in locus of control are only transitory (Preuss and Hennecke, 2018).

How do differences in the total amount and composition of different forms of capital translate into differential histories of experiences of control over one's outcomes in the field of occupation? Greater *cultural capital* in the form of educational certificates provides access to a more diverse set of employment options, many of which allow for greater self-direction and autonomy at work. Individuals who lack such educational credentials may be forced into particular occupations and jobs. These are more likely to allow for little self-direction and autonomy at work. The daily experience of the possibility to work self-directed will likely foster a sense of agency in those with high amounts of human and symbolic capital. In contrast, experiences of external control and the irrelevance of own needs and preferences are expected to undermine feelings of agency in those with little human capital. Indeed, Wu et al. (2015) show in a longitudinal study based on HILDA

[13] The concept they measured was 'Attribution of Responsibility' defined as "Men's sense of being controlled by outside forces or of having some control over their fate"(Kohn and Schooler, 1969, p.667) which is essentially locus of control. Their study was based on a sample of 3100 men representative of the male U.S. workforce in 1964.

data that greater job autonomy and job satisfaction lead to an increase in employees' internal locus of control.

Higher amounts of *financial capital* allow longer job-search processes, thereby allowing a better fit with the searcher's interests and skills. This may lead to more motivation at work, better performance, and improved occupational outcomes, including promotion, higher status, better work-contracts, and higher wages. A sense of agency and internal control is likely to result from such a history of experiences. Individuals with less financial resources may have to accept jobs that do not fit their interests and skills. More challenged and/or less motivated, these individuals may be more prone to experiences of failure or insufficiency, possibly leading to job losses and subsequent scarring with all of its adverse effects on prospective employment, wages, life-satisfaction and mental health (Arulampalam et al., 2001; Gangl, 2006; Knabe and Raetsel, 2011; Mavromaras et al., 2015; Stevens, 1997; Strandh et al., 2014).[14] These undesirable consequences are likely to impede feelings of agency and control over one's outcomes, deepening the vicious circle. A lack of financial capital may also force individuals into insecure employment relationships such as temporary and contract work. Insecure employment relationships will naturally foster feelings of external control.

The amount and composition of a person's *social capital* affect the information and support to which the person has access. Both affect the probability of attaining desired outcomes and thus foster experiences of contingency, empowerment, and agency. Granovetter (1973) prominently stressed the importance of the diversity and extensity of social networks in providing access to relevant information in the job-search process. As far as close social ties are concerned, it is primarily the quality and density of such networks that may affect experiences of agency and conditionality. The inability to build or maintain positive, functioning and stable relationships with family and friends may be experienced as a loss of control over one's life. Consequential negative emotional affect may, in turn, affect performance at work and lead to negative consequences in the occupational realm, again undermining feelings of conditionality and agency. Receiving positive support from loved ones, on the other hand, may enhance performance at work. Close social ties may be helpful in solving interpersonal problems at work and assist intra-personal development, all of which may foster experiences of achieving desired outcomes, which then, despite external help, can be ascribed to the self.

[14] These adverse effects are offset to some degree by welfare-state regimes such as unemployment benefits (DiPrete and McManus, 2000; Gangl, 2004).

Higher symbolic capital increases attention and respect that is paid to a person in the workplace. Individuals who receive more attention and whose opinion is more respected will more easily be able to enforce their ideas or suggestions in the workplace. An individual with the same idea, but no symbolic capital, is likely to face more obstacles in enforcing their ideas and may not even get the chance to be heard. Hence individuals with more symbolic capital are more likely to experience a more significant contingency.

In general, a larger total amount of resources provides a framework for agency, while shortness of resources diminishes opportunities for effective action. This not only applies to the world of work but also other fields, including health, education, and political participation. Based on these experiences of contingency and control, locus of control is formed. Hence locus of control should amount to a relatively accurate reflection of individual's actual opportunities to affect their outcomes. But what does *relatively* accurate mean? The answer to this question is explored in the next section.

> ***Proposition III:*** *Individuals locus of control orientation is a relatively accurate representation of their actual circumstances, which are defined by the amount and composition of resources to which they have access.*

5.2.3 Psychological mechanisms affecting perceptions of contingency

Most theoretical accounts that aim to explain social class differences in locus of control assume that the process by which locus of control is generalized is not free of bias. This section explains how these biases come about.

A frequently encountered line of argument is that control beliefs are not a realistic reflection of an individual's actual opportunities but that control beliefs are adjusted such as to be psychologically beneficial.

One theory developed to explain social class differences in locus of control is the *consolation price theory of alienation.* The *consolation-price theory of alienation* hypothesized that rejecting responsibility for live-outcomes (i.e., externality) helps low-status individuals cope emotionally and cognitively with their position in society (Hyman, 1966; Merton, 1946; Mirowsky and Ross, 1990a). Merton (1946, cited in Rotter, 1966, p. 3) suggested that a belief in luck might be a "psychological function of enabling people to preserve their self-esteem in the face of failure" (the consolation). The adoption of external control beliefs alleviates cognitive dissonance (Festinger, 1957), a feeling of distress that results from the need to maintain a positive self-image while holding a low position in the social structure. Pointing out that this cognitive process acts as a "a self-imposed barrier" to advancement Hyman (1966, p. 448) was the one to highlight the prize that is paid for the consolation.[15] In sum "[t]he consolation-prize theory of alienation makes two core assertions. The first is that an individual's sense of control is increased by socio-economic status (SES) and resources. The second is that the subjective effect of a sense of control depends on the individual's status and resources. A sense of control over, and responsibility for, the outcomes in one's own life is distressing for low-status persons, who have few resources. It is comforting for high-status persons, who have many resources" (Mirowsky and Ross, 1990a, p. 1508).

Despite its intuitive appeal, only parts of the consolation-prize theory of alienation could withstand empirical rigor. While it has been repeatedly confirmed that individuals from lower social strata tend to hold more external (less internal) control beliefs, no association between externality and reduced levels of distress was found (Hyman, 1966; Mirowsky and Ross, 1990b; Wheaton, 1980). "Apparently, the subjective benefits of a greater internal locus of control are at least as great for people in low-status positions with sparse resources and opportunities as they are for people in high-status positions with plentiful resources and opportunities" Mirowsky and Ross (1990a, p. 1510).

In response to these findings two alternative hypotheses have been developed: *The illusionary control as false consciousness theory*, claims that a greater sense of control - even if illusory - is psychologically and practically beneficial, regardless of social status, because it reduces distress that results from a lack of control and motivates action (Kluegel and Smith, 1986). The *threshold of dysfunction* theory (Wheaton, 1980), in contrast, contends that internality becomes detrimental when it is harshly in excess of a person's realistic opportunities for effective action. This threshold of dysfunction is marked by "the point at which the problems caused by greater illusion exactly cancel the benefits from greater motivation and striving" (Mirowsky and Ross, 1990a, p. 1516).

[15] Hyman's (1966) empirical investigations confirmed that low-status individuals were less likely to believe that hard work could get them a promotion. Moreover, low-SES individuals were also less likely to believe that the quality, energy, and willingness they brought to work determined advancement. In line with the consolation hypothesis, he gauges this value system "a realistic appraisal of reality" that "softens for the individual the impact of low status" (Hyman, 1966, p. 488).

Mirowsky and Ross (1990a) formalized the theories above and formulated a unified theoretical model. The critical innovation of their *unified model of instrumental realism* is that the threshold of dysfunction differs by socio-economic group. Their model decomposes sense of control into two parts: A part that is explained by social status and hence justified; and an illusionary part. If the sense of control held by a person exceeds the sense of control that is justified based on their social status, the illusionary part is positive. The smaller the illusionary part, the greater is the person's realism. The unified model of instrumental realism assumes that actual effectiveness (i.e., the ability to reach one's goals) is negatively associated with psychological distress. The level of actual effectiveness is determined by the person's socio-economic resources and their realism (Mirowsky and Ross, 1990a). Internality that is justified by social status is predicted to have a strictly positive effect on actual effectiveness. Internality that is in excess of what is justified by socio-economic status is hypothesized to have a curvilinear effect on actual effectiveness. Individuals benefit from over-estimating their ability to affect outcomes, but the positive effects of this optimism have a limit. Because Realism increases with social status, this threshold increases with social status. The model of instrumental realism thus allows calculating an 'optimal' internality for each individual, given a particular distribution of resources and a particular definition of the distress that is to be minimized.[16]

Testing their theory against cross-sectional survey data of 809 U.S. adults Mirowsky and Ross (1990a) found evidence in favor of the theoretical predictions of their model. When psychological distress (as measured by individuals' levels of depression and anxiety) was predicted by realistic and illusionary internality, realistic internality predicted distress linearly, while for illusionary internality only the quadratic term was significant. Their results indicated that almost 90 percent of the individuals in their sample were less internal than their individual optimal internality. Other empirical tests of the theory have cast doubt on the existence of a threshold of dysfunction. Using data from the National Comorbidity Study on over 5000 U.S. adults Kiecolt et al. (2009) found that psychological distress (measured by levels of depression and anxiety)[17] decreased monotonically in locus

[16]Note that such an 'optimal' sense of control may only be a local optimum - the optimum given the current distribution of goods and privileges. To find the global optimum, the distribution of goods and privileged would need to be adjusted first to raise those at the lower, followed by an adjustment of the individual locus of control to be optimal given this new distribution.

[17]Psychological distress measured on a 10-item scale, based on the Hopkins Symptoms Checklist. Re-

of control[18] regardless of social status. In line with the predictions of the theory of instrumental realism, they found that reductions in distress decreased as internality increased. The decrease was also more pronounced for low-status individuals. Greater internality was, however, never positively related to distress. A direct test of the unified model of instrumental realism confirmed the hypothesized functional form, the predicted threshold of dysfunction was, however, outside of the observed range of control orientations. Kiecolt et al. (2009) concluded that consolation is offered by embracing greater internality, not less.

All of the above studies utilized psychological distress, anxiety, or depression to operationalize 'consolation'. Consolation may, however, come in other forms than reduced anxiety and depression. A related strand of literature, that also explains differences in the attribution of control motivationally (i.e., assuming a motivation behind certain patterns of attribution, rather than a non-motivated cognitive bias for example) focuses on self-esteem rather than distress. In contrast to the theories above, this strand of literature was not developed to explain social class differences in attributional styles or control beliefs. In fact, the consolation hypothesis could be considered a special application of the more general phenomenon known as *self-serving bias* (Heider, 1958).[19] Broadly defined "[a] self-serving bias is any cognitive or perceptual process that is distorted by the need to maintain and enhance self-esteem" (Forsyth, 2008). Within attribution research the self-serving attribution bias describes the phenomenon that individuals are more likely to attribute positive outcomes to internal factors such as ability and effort, whereas negative outcomes are more likely to be attributed to external factors like the situation, luck or fate (Miller and Ross, 1975; Zuckerman, 1979). Motivational attribution theory suggests that the reason for this asymmetric attribution is the need to maintain or enhance self-esteem (Zuckerman, 1979). The observed differences in attribution may, however, also be due to cognitive distortions[20], a-priori performance expectations[21], or the need to maintain a

spondents were asked to indicate on a scale from often (4) to never (1) how often in the last 30 days they felt trapped, suddenly felt scared for no reason, felt lonely, felt blue, worried too much about things, felt no interest in things, felt frightened, had trouble concentrating, felt tense or keyed up and that everything was an effort (Kiecolt et al., 2009).

[18]Locus of control was measured by a set of items from Levensons's IPC scale. Items for the powerful others and the chance scale were recoded and a single indicator signifying internality was constructed.

[19]The principle has also been termed 'ego defense, ego-protective, or ego-biased attribution' (Miller and Ross, 1975).

[20]Miller and Ross (1975, p. 218) point to evidence that suggests individuals "actually perceive a greater relationship between behavior and positive outcomes than between behavior and negative outcomes" to argue that the greater attribution of successes to internal factors may be a cognitive bias, rather than a motivational one.

[21]Miller and Ross (1975) highlight evidence suggesting that unexpected outcomes are more likely to be

positive image in front of others (Bradley, 1978; Miller and Ross, 1975). Empirical tests of the phenomenon could, however, provide evidence that is supportive of the explanation based on the need to maintain a positive self-esteem (even if only for oneself) (Greenberg et al., 1982; Weary, 1979; Zuckerman, 1979). Further theoretical refinements that received empirical support indicate that the bias only appears for outcomes that are affectively relevant to the person (McCarrey et al., 1982), when improvement is possible (Duval and Silvia, 2002) and increases with the potential threat to the ego (Campbell and Sedikides, 1999).

Most likely motivational and cognitive processes jointly produce the self-serving attribution bias (Shepperd et al., 2008; Tetlock and Levi, 1982). For example people have been found to be more likely to remember, acknowledge and seek information that confirms already held beliefs or expectations (Nickerson, 1998). This phenomenon is known as *confirmation bias*. Confirmation bias may be further exacerbated by *motivated skepticism* (Ditto and Lopez, 1992). Motivated skepticism assumes that less supportive evidence is required to arrive at a desired conclusion, than to arrive at an undesired conclusion.[22]

What is known about the self-serving attribution bias can be employed to rationalize social class differences in locus of control. Posing a potential threat to the ego low social status is likely to activate the self-serving bias, especially when improvement seems out of reach. Individuals from less privileged socio-economic groups may be motivated to adopt more external control beliefs to protect their self-esteem. Individuals from privileged social status may be prompted towards internality to maintain their self-esteem. Once adopted cognitive biases, including the confirmation biases and motivated skepticism facilitate maintaining these beliefs. The selective information processing that is introduced trough the motivational and cognitive biases is thus likely to exacerbate initial social class

attributed externally while expected outcomes are more likely to be attributed internally - regardless of whether the outcomes are positive or negative. This line of argument builds on Heider's (1958) *balance theory of attribution* which assumes that causality attributions will be adjusted in such a way as to confirm prior self-evaluations of the self. This means that "positive outcomes will be attributed to the self when there is positive self-evaluation with respect to the performance task (high expectations of success), but will be attributed to external factors when there is negative evaluation (low expectation of success). Similarly, with failure, negative self-evaluations produce internal attributions, and positive self-evaluations yield external attributions" (Miller and Ross, 1975, pp. 218-219). Hence, it is not about maintaining a positive self-image, but rather just one that fits.

[22] According to Gilovich (1991) and Ditto and Lopez (1992) two different types of questions are asked by lay people when evaluating the evidence in favor of desired as opposed to undesired conclusions. When the conclusion is desired, individuals will ask 'Can I believe this?', where as when the conclusion is undesired they would ask 'Must I believe this?'.

differences in locus of control that are due to differences in objective circumstances further.

How is this compatible with the empirical evidence on the consolation price theory, which found that no consolation was offered by external control attributions? The main difference between to two strands of literature is the operationalization of the consolation. While the literature that evolves around the alienation price theory mostly relied on measures of *affective* well-being, including signs of depression and anxiety, the self-serving bias literature is based on measures of *evaluative* well-being. One might thus hypothesize that although external causal attributions cannot immunize individuals against negative affect, they can effectively protect individual's self-evaluations.[23] The proposition is in line with Cummins and Nistico (2002) theory of life-satisfaction homeostasis, according to which cognitive biases regarding control are a central element in explaining the extraordinary stability of overall life-satisfaction. It is also in line with evidence that suggests that status indicators, such as employment status and income, are more consistently related to evaluative well-being, than to affective well-being (an Hoang and Knabe, 2020; Kahneman and Deaton, 2010; Knabe et al., 2010, 2016; von Scheve et al., 2017).

> ***Proposition IV:*** *Psychological mechanisms and cognitive biases jointly affect individual's locus of control orientations in ways that exacerbate social class differences in locus of control that are due to differences in the objective circumstances.*

5.2.4 Intermediate and long-term consequences: Reproduction of inequality

Having explored likely causes of social class differences in locus of control, the next step is to investigate their consequences for status attainment in the medium and long run. Adopting a life-course perspective is particularly important considering that locus of control is based on a person's history of experiences and therefore constantly updated.

In the *medium run*, these causal attributions become *self-fulfilling prophecies.* Self-fulfilling prophecies occur when a false definition or perception of a situation evokes be-

[23] Although self-esteem and evaluative measures of well-being such as general life-satisfaction are not the same (Diener and Diener, 2009), evaluative well-being is very much based on evaluations of the self (Cummins and Nistico, 2002).

havioral reactions that make the originally false conception come true (Merton, 1948).[24] This is easily applicable to the present case: High-SES individuals, who are expected to hold more internal control beliefs, are predicted to adopt more active coping strategies, invest more into their future and exert more effort - at least in the presence of agency and means-ends beliefs. Low-SES individuals, who are predicted to be more external (less internal), in contrast, are expected to "lower coping effort and (...) increase the chances of the appearance of maladaptive responses in the face of environmental demand" (Wheaton, 1980, p. 107). Social class differences in locus of control are thus likely to harden the cleavage between socio-economic groups in the medium run.

What long-term consequences can be expected? When "[s]uccess is followed by an increment in the tendency to make internal attributions, whereas failure is followed by an increment in the tendency to make external attributions" (Wheaton, 1980, p. 107) the constant updating of control beliefs and subsequent changes in behavioral responses may be self-enhancing. Social class differences in locus of control may therefore spark processes of cumulative (dis-)advantage (in the Mertonian sense).[25] Greater internality among the privileged entails greater efforts and thus greater success on the basis of which more internality becomes justified. Greater externality, or less internality among those at the bottom of the social distribution may lead to greater fatalism, less effort and less effective coping, experiences of external determination through the social-security system, few autonomy at work etc. all of which justify even greater externality and less effort.

In sum, social class differences in locus of control may not only reproduce but even exacerbate social class differences across the life-course.

> ***Proposition V:*** *Social class differences in locus of control act to reproduce (and even exacerbate) initial differences in socio-economic resources over the life-course.*

[24]Self-fulfilling prophecies are sometimes also referred to as the 'Thomas Theorem' referring to William Isaac Thomas' and Dorothy Swaine Thomas' contention that "If men define situations as real, they are real in their consequences" (Merton, 1948, p. 193).

[25]DiPrete and Eirich (2006) distinguish cumulative advantage in the Merton (1988) sense from cumulative advantage in the Blau et al. (1967) sense. Cumulative advantage in *Merton's sense* describes the phenomenon where current levels of accumulation affect future levels of accumulation of some resource. Cumulative advantage in the Blau-Duncan sense describes differential group returns to a particular resource or characteristic.

5.3 Intergenerational socio-structural influences on locus of control

This section will extend the previous section's analyses to a multi-generational framework: It explicates the theoretical pathways through which social-class differences in locus of control might be transmitted *socially* from one generation to the next. Bandura's (1977b) social learning theory serves as a framework. Social-learning theory posits different sources of learning (see Figure 3.1 in Section 3.6) (Bandura, 1977a).[26] Own experiences are predicted to have the strongest effect on learning. Vicarious experience (i.e., learning through others' experience) and verbal persuasion may also be relevant sources of learning, especially when own experiences are not available (Bandura, 1977a). As learning from own experiences is considered the most relevant source of learning (Bandura, 1977a) it will receive most attention.

5.3.1 Learning from experience: Differences in parent-child interactions

Two distinct channels can be identified in the literature through which differences in parents' cultural milieu and socio-economic resources cause differences in the experiences made by the children from which locus of control is formed. The first channel claims that parent-child interactions will differ due to differential parenting goals that derive from differences in the parents' occupational environments. The second channel claims that parent-child interactions will differ as a consequence of parental distress that is due to a scarcity of resources. Although these two channels have been discussed independently in the literature, they are most likely to interact and reinforce each other in creating the experiences from which children's locus of control orientation is formed (Sherman and Harris, 2012).

5.3.1.1 Explanations referring to differences in culture

The first channel assumes that social class differences in locus of control can be traced back to cultural differences between the classes in terms of their values. The underlying assumption of this channel is that parents aim to prepare their children for life and that they use their own experiences to determine what kind of characteristics and values might be helpful in navigating life's demands. Melvin Kohn (1959) was the first to hypothesize

[26] Although Bandura's social learning theory has been formulated for self-efficacy, the sources of learning may equally apply to locus of control.

that parents would try to foster those characteristics and values in their children that are demanded in their own occupational environment.[27] In a series of studies, Kohn and his colleagues showed that middle class-parents value self-direction and dependability and are more likely to penalize behaviors that indicate loss of self-control, whereas working-class parents placed greater emphasis on obedience and penalized transgressions of external proscriptions (Kohn, 1959, 1989; Kohn and Schooler, 1969, 1983).[28] Pearlin and Kohn (1966, p. 469) identified self-control and obedience to "embody most clearly the essential difference between the middle-class emphasis on self-direction and the working-class emphasis on conformity to external prescription". They also showed that these differences in parental values and parenting behaviors could be entirely explained by parental occupational circumstances such as the closeness of supervision and the degree of self-reliance on the job (Pearlin and Kohn, 1966).

While not directly concerned with locus of control, the empirical evidence provided by Kohn and his co-authors goes a long way in explaining the observed social class differences in locus of control. It seems evident that an environment that values obedience and penalizes transgression of external prescriptions creates experiences of external control and thus externality. Emphasis on self-direction, dependability, and self-control is likely to foster experiences of control and thus internality.

One should keep in mind, however, that Kohn's findings are based on surveys from

[27] Kohn's hypothesis is typically referred to as *Occupational Linkage Hypothesis* as it establishes a link between the parents' occupational conditions and children's characteristics.

[28] Kohn (1959) first discovered that middle and working-class parents differed in the values they considered important in the education of their five-year-old children in a study of 400 working and middle-class families in Washington, DC. While working-class mothers and fathers valued obedience and neatness, middle-class parents were more likely to value curiosity, dependability, consideration, and self-control (Kohn, 1959). The results were replicated in a sample of parents from Italy (Pearlin and Kohn, 1966). Pearlin and Kohn (1966, p. 466) hypothesized that "class differences in parental values appear to parallel, and may very well be a result of, the characteristically different occupational experiences of middle- and working-class parents" and provided evidence for this hypothesis. Three years later, these results were confirmed for the U.S. in a nationally representative sample (Kohn and Schooler, 1969). In another study, Kohn et al. (1979) could show that parental values and how children were raised differed with parental job characteristics. In line with their focus on self-direction, middle-class parents were found to be more prone to penalize behavior that shows signs of loss of control, while working-class parents were likely to penalize behavior that transgresses external proscriptions (Kohn et al., 1979; Sewell, 1963). Finally, Kohn et al. (1986) show for a representative sample of men employed in the U.S. and Poland that these differences in parental values affect not only child-rearing behavior but also adolescent and young adult children's values. Kohn et al. (1986, p. 99) conclude that "all the links in the causal chain are strong: Social stratification affects parental occupational self-direction; occupational self-direction affects parental values; parental values affect children's values". Although the correlations of class with parental values are not very strong, the consistency of the correlation across diverse countries is impressive (Kohn et al., 1979).

the 1950s to 1970s. Parenting values and practices have changed quite a deal since then. Changes may be due to changes in the parent's occupational environments, or due to reasons not related to parents' labor market positions. Since the 1950s, national governments and civil society organizations have launched educational campaigns on good parenting practices. The internet has made information on parenting practices that foster the skills and values required for the twenty-first century more accessible than ever before. The great accessibility of such information may have reduced the influence of parent's occupational context on parenting goals. As a consequence, social-class differences in parenting practices may have reduced. In line with this reasoning, early replications of Kohn's original work found a general trend towards a greater valuation of self-direction by all classes (Wright and Wright, 1976). The same studies confirmed, however, that class remained the most important indicator of self-direction (Wright and Wright, 1976). Evidence from larger surveys Xiao (2000) and smaller qualitative studies (Tudge et al., 2000) confirmed that class continued to be a relevant predictor of the valuation of conformity and autonomy in the 1990s. One interesting test of the association between parental class and parental values among younger birth-cohorts is provided by Park and Lau (2016).[29] The authors combine individual survey-data on over 227,000 parents from 90 different countries from the 1980s until 2008 with country-level indicators of socio-economic development to investigate how social class differences in parental values have evolved in differential institutional and cultural settings.[30] They found that parental valuation of independence increased with parental income and education, whereas parental valuation of obedience decreased with income and education. In general, they observed greater valuation of independence in later birth-cohorts, independent of socio-economic status. For the valuation of obedience, no such time trend was found. Park and Lau (2016) suggests that while self-direction appears to gain in importance as the overall level of development increases, parental social class continues to be a prime determinant of parent's valuation of self-direction and obedience in many institutional contexts.[31]

In sum, it seems that social class, as measured by education, occupation, and income, still is a major determinant of class differences in parental values in market-economies,

[29] The study by (Park and Lau, 2016) does not directly test the occupational linkage hypothesis but a more general association between parental class and parenting values.

[30] Individual level survey data are obtained by combining five waves from the European and the World Values Survey. Country-level indicators of socio-economic development were obtained from the World Bank Data Cataglogue (Park and Lau, 2016).

[31] There is, however, also evidence that suggests that the validity of the occupational linkage theory may be restricted to market economies and may not extend to centrally planned economies (Hong, 2013).

despite the enormous changes that have been observed in the occupational and educational field since it was developed.

> ***Proposition VI:*** *Parents will aim to instill those locus of control orientations in their children that prove to be functional in their own societal position.*

5.3.1.2 Explanations referring to resources

The second channel ascertains that the different experiences made by children from high- and low-status households originate in the *presence or absence of critical resources in the parental household*. This channel argues that parenting practices which are currently regarded as most beneficial to the children's development are "child-centered, expert-guided, emotionally absorbing, labor-intensive, and financially expensive" (Hays, 1996, p. 8 cited in Sharon, 2012, p. 65) and may therefore be more difficult to provide for lower-class parents. The theoretical foundations are presented first. Then empirical evidence for all the relevant steps in the process is reviewed.

Theoretical accounts for the second channel are provided by the *Family Stress Model* and a *formalized and extended version* of it put forward by Cobb-Clark et al. (2019).

The *Family Stress Model* predicts that whether economic hardship or a lack of resources more generally,[32] affects child development depends on the parents' evaluation of the situation and their ability to cope with it. The model was developed in response to empirical evidence that shows that economic hardship as such does not directly affect children's human capital development, but that detrimental effects of economic hardship are mediated via the parents' ability to deal with difficult situations (Elder et al., 1992). The theory argues further that economic strain is particularly dangerous if coupled with a breakdown of marital civility (McLoyd, 1998), or a loss of other sources of socio-emotional support to the parents. Lacking the resources to relieve their distress or cope with it, parents are likely to get distressed, leading to a deterioration of parent-child interactions.

Cobb-Clark et al. (2019) model parenting style as an investment decision in the production of human capital. Parental investment decisions are constrained by the amount of resources available to the parents. Modeling parental investments as endogenous allows Cobb-Clark et al. (2019) to explain social class differences in parenting without having to

[32] Originally formulated exclusively for financial resources, the model can be extended to comprise other types of resources.

assume heterogeneity in parental preferences. The critical innovation of their model is that they extend the conceptualization of investments to include not only financial and temporal investments (as previous accounts have done) but also *cognitive effort* or *attention.* Cobb-Clark et al. (2019, p. 1317) “believe that it is quite natural to view many effective parental behaviors (e.g., establishing control, discipline, and routine) as being much more taxing of mental effort and attention than of either money or time”. Parental cognitive resources are assumed to increase with parents’ socio-economic status.

Qualitative and quantitative empirical investigations show that low-status parents are more likely to employ less resource-intensive parenting practices, both in terms of the *activities* that are done with the child or organized for them (i.e., *What* parents do with or for their children), and in terms of the *quality* of parent-child interaction (i.e., *How parents interact with their children.*). In the following, empirical evidence on social class differences with regards to these two dimensions, and their respective effect on locus of control is reviewed.

Evidence on the association between parental SES and the *content* of parent-child interactions: A seminal study in this literature is Annette Lareau’s (2011) observational study of twelve middle and lower-class families which revealed considerable social-class differences in parenting styles.[33] Lareau (2011) found that middle-class parents schedule and structure their children’s leisure-time to include organized leisure time activities, they engage their children in more dialogue and logical reasoning, and they are closely involved in their schooling.[34] Working-class parents were more likely to apply a parenting style she termed ‘accomplishment of natural growth’. This parenting style is characterized by less parental involvement in children’s leisure time (demanding less parental resources)(Lareau, 2011). According to Lareau (2011) the parenting practices employed by middle-class families give rise to a sense of entitlement. Parenting practices encountered in lower-class families, in contrast, are hypothesized to induce a sense of subordination and powerlessness. In line with Lareau’s qualitative findings, quantitative evidence found that parenting practices in families characterized by high income (Ermisch, 2008) and high education (Kaiser and Diewald, 2014) were more structured in the sense that there are more

[33] The most important dimensions along which parenting styles differed were parental values, communication styles and parental interaction with institutions, and how children spend their leisure time.

[34] Lareau termed this parenting style ‘concerted cultivation’.

Table 5.2: Classification of parenting styles according to Baumrind (1971) and Maccoby and Martin (1982)

		Demandingness/Control	
		high	low
Responsiveness/	high	Authoritative	Authoritarian
Warmth	low	Permissive	Neglectful

Note: The table shows a frequently used classification of parenting styles initially developed by Baumrind (1971) and elaborated upon by Maccoby and Martin (1983).

rules and regular routines, and involved more resource intense child-centered parenting activities, such as reading to the child, looking at picture books, singing children's' songs, counting, teaching the alphabet, painting and crafting.[35] Moreover, rules were more clearly enforced in high income families (Ermisch, 2008). For less resource-demanding activities such as going to the playground or going shopping with the child, no social gradient was found (Kaiser and Diewald, 2014).

Evidence on the association between parental SES and the *quality* of parent-child interactions: Most of the literature that focuses on *how* parents interact with their children categorizes parenting styles according to the degree of responsiveness,[36] or warmth that is provided, and the level of demandingness[37] or control that is exerted over the child (Baumrind, 1971; Maccoby and Martin, 1983). Along these two axes, four distinct parenting styles can be distinguished (Table 5.2): Authoritative parenting is characterized by high levels of warmth and control. Neglectful parenting is characterized by a lack of control and warmth. Indulgent parents are warm and responsive but exert a low level of control, while authoritarian parents exert a high level of control while not showing much warmth to their children.

Cross-sectional as well as longitudinal studies provided evidence linking a lack of resources in the household to heightened parental distress, which results in maladaptive

[35]The study by Ermisch (2008) was based on a representative sample of three-year-olds in the U.K. The study by Kaiser and Diewald (2014) was based on a representative sample of 2-3-year-old children in Germany.

[36]Responsiveness measures "the extent to which parents intentionally foster individuality, self-regulation, and self-assertion by being attuned, supportive and acquiescent to children's special needs and demands" (Baumrind, 1991, pp. 61 - 62).

[37]Demandingness measures "the claims parents make on children to become integrated into the family whole, by their maturity demands, supervision, disciplinary efforts and willingness to confront the child who disobeys" (Baumrind, 1991, p. 61)

changes in parenting practices such as a reduction in warmth and nurture, and increased inconsistent and punitive parenting for both mothers and fathers (Bradley and Corwyn, 2002; Conger et al., 1992; Elder et al., 1992; Fauber et al., 1990; Lempers et al., 1989; McLeod and Shanahan, 1993; McLoyd et al., 1994; McLoyd and Wilson, 1990).[38] Cobb-Clark et al. (2019) also tested their theory empirically using administrate welfare records matched to survey data. Their results indicate that socio-economic disadvantages reduce parental monitoring significantly. Although some of these studies demonstrate associations between parenting practices and children's development, none of them directly connected parenting practices to locus of control. Theoretically, this connection is easy to establish.

It is intuitively plausible that parenting routines, the activities parents undertake with their children (*what*), and *how* parents and children interact affect children's locus of control orientations. Regarding the content of parent-child interactions, it can be hypothesized that greater exposure to activities that allow experiences of control and self-efficacy enhances internal control beliefs. For example, building something together, doing handcrafts, and allowing the child to help with cooking, should foster children's internality. Also, institutionalized activities that do not involve the parents directly may evoke feelings of control. As far as the quality of parent-child interactions is concerned, the environment's responsiveness and consistent parenting are central to the formation of children's locus of control. Experiences of an unresponsive environment are likely to undermine internal control convictions. When parenting is inconsistent, particularly when combined with the erratic application of disciplinary measures and harsh punishment practices, the child is likely to feel exposed to powerful others.

> ***Proposition VII:*** *A lack of resources in the parental household may evoke more external control beliefs in children by reducing parents' ability to be responsive to children's emotional and developmental needs in terms of the activities undertaken with the children and the quality of parent-child interactions.*

Evidence on the influence of the *quality* of parent-child interactions on lo-

[38]Based on survey data from the NLSY, McLeod and Shanahan (1993) found that current economic pressure experienced by single-mothers leads to decreased emotional responsiveness and more frequent use of physical punishment. Using observer ratings of parental depression and parent-child interactions, and parental reports of economic distress Conger et al. (1992) found that family economic pressure increased parental distress which in turn decreased parental warmth and involvement, monitoring, positive reinforcement, and encouragement while increasing parental hostility and harsh discipline. McLoyd and Wilson (1990) showed that parental distress following economic hardship reduces warmth, responsiveness, and adequate levels of monitoring while increasing the use of negative control strategies.

cus control: In line with the theoretical expectations above, the empirical literature has repeatedly found associations between parenting practices and particular types of parent-child interaction with children's locus of control orientations. The clearest finding of the literature is that a parenting style that combines high levels of responsiveness and warmth with high levels of supervision and demandingness (authoritative parenting) is most conducive to the development of internal locus of control orientations. This result has found support in observational studies (Chandler et al., 1980)[39] as well as studies based on survey data using retrospective reports from adolescent (Krampen, 1989; McClun and Merrell, 1998; McIntyre and Dusek, 1995; Nowicki and Segal, 1974) and adult (Johnson and Kilmann, 1975) children. In longitudinal designs, greater internality was associated with developmental stimulation (Ahlin and Lobo Antunes, 2015) and greater interest in the child's attainments (Schurer et al., 2014).[40] Externality, in contrast, was associated with authoritarian parenting (McClun and Merrell, 1998) over-protectiveness, and restrictiveness but also high levels of demandingness (Johnson and Kilmann, 1975) and high levels of psychological control (Nanda et al., 2012). Longitudinal studies using prospective information on perceived or reported parenting practices confirm these findings. Externality was associated with more liberal parenting views, inconsistent reinforcements, harsh discipline and verbal and physical abuse (Krampen, 1989; Schurer et al., 2014).[41] However, the size of the effect is somewhat smaller when using prospective rather than retrospective measures of parenting practices (Krampen, 1989). In the literature on self-efficacy, parental responsiveness, support and encouragement, use of inductive control (which relies more on reason than on coercion), and high achievement demands have been significantly related to children's self-efficacy (Gecas, 1989). As with locus of control, children's perceptions of parental behavior have been shown to be more consistently and more strongly associ-

[39] Observing parent-child interactions where children had to build a simple figure with building blocks Chandler et al. (1980) found that parents of internals accepted and rewarded independence of their children more, they gave suggestions rather than directions and offered more positive encouragement than parents of children with an external locus of control. The simultaneous measurement of children's locus of control and parental behavior prevents any conclusions about the direction of the causality.

[40] Using parent's as well as children's reports on parenting practices Ahlin and Lobo Antunes (2015) finds that greater supervision at home predicted internal locus of control six years later, whereas harsh discipline was negatively associated with internal locus of control six years later. Parental warmth ceased to be a significant predictor of internality once the author controlled for extra-familial influences on locus of control. Developmental stimulation became a significant predictor of internality after controlling for extra-familial influences.

[41] Krampen (1989) collected reports on parenting practices from parents and their eleven to thirteen-year-old children ten months before measuring children's locus of control orientation. Although reverse causation is tested for and not confirmed, the study cannot exclude reverse causation that was active at the time before the first measurement. The study by Schurer et al. (2014) finds that children of mothers who had more liberal parenting views when the participant was five were more external by the age of 10

ated with children's self-esteem than parental reports of their own parenting (Gecas and Schwalbe, 1986).

In sum, the evidence from studies using observational, as well as prospectively and retrospectively collected information on perceived, observed, and reported parenting practices indicates that an attentive, responsive and warm parenting style, in which an appropriate amount of control is exerted, while still leaving enough room for autonomous action and exploration, is most conduce to the development of an internal locus of control and feelings of self-efficacy. Over-control and harsh discipline, and a lack of interest, neglect, and inconsistent parenting, appear to produce external locus of control or diminish internality.

Evidence on the influence of the *content* of parent-child interactions on locus control: The literature on the association between the content of parent-child interactions and children's locus of control orientations is more sparse and much more difficult to summarize as the types of activities to investigate are endless. While theory may guide the selection, the list of potential activities remains immense. Acknowledging this fact, Nowicki et al. (2018a), explored potential early-home-life influences on children's locus of control development following a hypothesis-free, exposome strategy, using data from the Avon Longitudinal Study of Parents and Children (ALSPAC). They investigate how 1355 characteristics of the early home environment measured before the child was five relate to locus of control when the child is eight years old.[42] Their findings indicated that children were more likely to become externally oriented when the TV was on almost all of the time, and when mothers felt that pets should be considered a member of the family, and when the mother cleaned the children's hands more often before meals. Reading stories to the child and cuddling the baby when it woke at night and providing a healthy diet were associated with more internality. This type of exploratory research shows the need to abstract from the concrete practices to more general categories that capture the attitude or intention and the meaning of particular actions. The results found by Nowicki and his colleagues might show that greater attention to the child, a warm and nurturing approach to the child that does not over-control is most conducive to the child's locus of control.[43]

[42] The practices were grouped (early home experiences, early parenting, and dietary practices) backward stepwise logistic regressions were used to single out those activities that were most related to children's later locus of control orientation.

[43] Nevertheless, this type of research is relevant, as it helps to understand the particular meaning behind more abstract concepts. After all, a 'warm and attentive' environment may mean different things to

Evidence on the influence of shocks in the parent's life on locus control: The resource-based channel may also explain the associations that have been found between various kinds of shocks in the parent's life and children's locus of control. For example, parental job-loss (Peter, 2016)[44] family disruption (Prevoo and Weel, 2014) and the experience of several partnership transitions (Peter and Spiess, 2016) have been associated with slower increases in locus of control during adolescence. In general, single parenthood has been shown to be negatively associated with internality (Duke and Lancaster, 1976; Schurer et al., 2014). All of these shocks may reduce the cognitive resources of the parent. Involuntary job-loss is likely to additionally affect children via the loss of financial resources. While no connection to locus of control has been made so far, non-standard work-schedules, which are more frequently encountered in low-SES families, have also been associated with increased parental distress and lower-quality parenting (Li et al., 2014; Prickett, 2018).

5.3.1.3 A comment on the distinctness of the two channels

While the two channels have evolved separately their origins may not be that distinct. Both originate in the parents' position in society. The research by Kohn and his colleagues supports Bourdieu's (1984) assertion that values, as part of the habitus, are not a free choice, but rather reflect the requirements parents encounter in their professional environments. The values which parents aim to instill in their children are endogenously determined by their position in society, just like the investment decisions in Cobb-Clark's (2019) model. Hence, children's locus of control orientations appear to be determined by their parents' position in society. The only difference in the two channels appears to be that the channel that operates via parents parenting goals is intentional and consciously chosen, whereas the changes in parenting practices that result from a scarcity of resources are likely to be less conscious, unintended and even in contrast to parents conscious intentions.

different people, and the meaning that is empirically tested is restricted to the particular actions that are used in particular scales.

[44] Peter (2016) traces all the theoretical links, showing that following an involuntary job loss due to plant closure, mothers were significantly less satisfied with their lives in general (as compared to mothers who had not lost their job) and spent less time reading to their children or going to the playground. At the age of 16, internal control of children whose mothers had experienced involuntary job-loss after the child's tenths birthday was about a quarter of standard deviation lower than those of children whose mothers had not lost their jobs.

5.3.2 Learning by observation and persuasion

The examples just given may not only influence children's locus of control orientations through their own experiences in parent-child interactions but also through the other two channels of learning: vicarious experience and persuasion (Bandura, 1977a). Low-SES children may vicariously experience a lack of control more often because their parents may be more prone to experience helplessness and loss of control in their own lives (Hatch and Dohrenwend, 2007). For example, parents in socio-economically deprived households may be subject to more unstable employment relationships, such as agency work. The vicarious experience of powerlessness may be exacerbated when a shortage of financial, cultural, and social capital in the household diminish the parents' ability to deal with uncontrollable events effectively (McLeod and Kessler, 1990). Even when feelings of helplessness are not communicated to the children, parents communicate their interpretations of certain events and circumstances to their children by their own affective and behavioral reactions. In addition to vicarious experiences of external control and helplessness, children in low-SES households may also more often be subject to narratives of powerlessness and external control. Parents may discuss their own situations with each other, family, and friends over the dinner table, at family occasions, or even directly communicate their feelings of helplessness to children. These vicarious experiences and narratives are likely to influence children's perceptions and evaluations of situations.

5.3.3 Some empirical precautions: Reverse causation, genetic confounding, and alternative explanations

Some precautions are necessary concerning the body of literature cited above. The estimated effects of parent's occupational circumstances or particular parenting practices on children's locus of control orientations may be biased when reverse causation, genetic confounding, and other alternative explanations are not controlled for. The potential bias is associated with the study design, therefore the following discussion is organized by the different research designs used in the literature.

Cross-sectional studies provide no information about the direction of causality. It is unclear whether children's locus of control is a consequence of certain parenting practices or whether parents adapt their parenting to children's locus of control beliefs. For example, parents of highly external children who indulge in helplessness may become more protective and less demanding. In *retrospective studies*, children's recalls of their parents' ways of interacting with them may be colored by their current locus of control orientations. Consequently, cross-sectional studies may over-estimate the effect of parenting practices on children's locus of control orientations.

The majority of the *longitudinal studies* cited above sought to ameliorate this problem by reflecting the hypothesized causal mechanism in the temporal order of the measurement of constructs.[45] While this design does solve the problem of biased recall, it still suffers from potential reverse-causation that has happened before parenting practices were measured. Moreover, this approach does not tackle genetic confounding and confounding from other variables. Parents' locus of control orientation is likely to be such a confounder. Parents' locus of control is likely to affect parents' social status. At the same time, it is likely to affect their children's locus of control orientation via the parents ability to cope with adversity and subsequent changes in parenting and via persuasion. Lekfuangfu et al. (2018), for example, showed that maternal LoC measured at the twelfth week of gestation strongly predicts maternal attitudes towards parenting style and actual time investments into their children measured later. Thus, if parental locus of control is not taken into account, the influence of parental SES and parenting practices is likely to be overestimated. Considering that all complex character traits are genetically determined to some extent (Plomin, 2003), it is highly likely that parts of the association between the parents' ability to effectively deal with a lack of resources, and children's locus of control orientations are genetically determined. Controlling for parental locus of control might capture at least parts of such a genetic influence. Only a handful of the studies cited above take parental locus of control into account (Ahlin and Lobo Antunes, 2015; Peter and Spiess, 2016). None of the studies above has used genetically informed designs, which would allow controlling for genetic confounding.[46] Hence, even in longitudinal studies, which typically found smaller associations between parenting behavior and children's locus of control (Krampen, 1989), this association is likely to be over-estimated.

Both problems mentioned above could be ameliorated by using longitudinal research

[45] Children's locus of control orientations are typically measured several months or years after the economic hardship and parents' reactions to it are experienced to capture medium to long-term effects.

[46] While information on parental as well as children's locus of control is available in some large-scale representative data-sets, including, for example, the SOEP, data-sets that enable genetically informed designs (e.g., twin or adoption data-sets) and contain information on locus of control are very scarce.

designs that focus on changes rather than levels. This type of longitudinal approach would allow to control for time-constant characteristics and thereby allow a less biased estimate of the effects of parenting practices on children's locus of control. This research design is, however, very demanding in terms of the data structure.[47] The high demands on the data-structure, as well as the need for large numbers of observations, might be the main reason for the lack of research applying this methodology to identify the influence of parental social status on children's locus of control orientations.

Finally, there may also be factors outside the parental home that influence children's locus of control orientations, which are correlated with parental SES. Examples of such influences might be the quality of care-institutions, characteristics of the neighborhood, and the locus of control orientation of peers. Not accounting for such sources of influence outside of the parental home might again inflate the predicted influence of parental SES on children's locus of control. Very few studies consider both familial and extra-familial influences on children's locus of control orientations (Ahlin and Lobo Antunes, 2015). This gap in the literature is also likely to be rooted in a lack of appropriate data. Multi-actor designs require a large amount of detailed information from different actors. Such studies are costly and risky because consent and responses from many individuals are needed to obtain a single case. Studies that take this approach tend to be smaller and regionally constrained, often focusing on a small number of distinct neighborhoods. Sometimes the researched neighborhoods even have a particular socio-economic profile. As a consequence, the evidence of these studies is difficult to generalize. The ability to link information on the household-context from representative surveys with small-scale regional indicators or survey data from institutions will provide opportunities for novel and innovative research designs at this end.

A single mechanism not discussed so far would bias results in the opposite direction: Social desirability. To the degree parents' or children's reports of parenting practices are adjusted to fit with current standards of 'appropriate' or 'good parenting', the estimates of

[47]It requires repeated measurements of all key variables. In addition, the time between measurements should neither be too short nor too long. If the interval between the measures is too short, potential effects may not be observed because changes in locus of control require some time to evolve. If the interval is very long, it becomes increasingly likely that other unobserved factors may have caused the observed changes in locus of control. Because changes are infrequently observed and because changes in psychological variables such as locus of control tend to be rather small, large numbers of observations are required to identify significant effects.

the importance of parent-child interactions for explaining social class differences in locus of control would be depressed. Observer ratings may offer a remedy if adequately applied. although observation studies both financially costly and temporally demanding. While direct observation for short periods (e.g., in a laboratory situation) may not solve the problem because parents are likely to adapt their behavior, video-taping the parent-child interaction at home may provide less biased information. Home observation studies are however financially costly and temporally demanding.

Considering all of the arguments above, one may conclude that although there is abundant empirical evidence connecting children's locus of control orientations to parental resources via the type and quality of parent-child interactions, the utilized analytical designs are likely to overestimate the influence of parent-child interactions on the children's locus of control. Based on findings from developmental behavioral genetics, some authors even questioned that differences in parenting practices within the normal range (i.e., excluding extreme neglect and maltreatment) would influence children's attributes at all (Pomerantz and Thompson, 2008). While the effect of parental-child interactions on locus of control may be smaller than what the currently available literature suggests, it may still be significant.There are, however, possibilities to improve research designs in order to get less biased results. Using truly longitudinal designs, utilizing genetically informed research designs, integrating information from multiple actors and using observational rather than reported data are some of them.

5.4 Summary, evaluation and societal consequences

Locus of control affects achievement-related outcomes by modulating the expected return to effort. Internality provides a framework for action but is not sufficient to motivate it. Externality, in contrast, impairs motivated action even in the presence of agency and means-ends beliefs. Therefore, the negative effect of externality is predicted to be greater than the positive effect of internality.

Within a lifetime, the objective circumstances and some cognitive and motivational mechanisms interactively construct the individual's locus of control. The objective circumstances are defined by the bundle of resources she has access to and her position in society. A greater set of resources is expected to give rise to more internal control beliefs, reflecting the individual's greater ability to exert control over their circumstances. A lack of resources and a low position within society are expected to incur feelings of powerlessness and external control. The general need to maintain a positive self-evaluation interacts with several cognitive biases to enhance the social divide in locus of control. Although adopting a more external locus of control does not console those in low positions in the sense of improving their affective states, it does help them to maintain a positive image of the self. Unfortunately, this adaptation of control beliefs has a prize. By undermining further efforts to improve one's situations, externality becomes a self-fulfilling prophecy in the medium-run and might even exacerbate the social divide over the life-course.

Existing social class differences in locus of control are transmitted to the next generation via the experiences and narratives to which children are exposed. Parental social class determines the values they aim to instill in their children as well as the activities parents undertake with their children or organize for them. Parents foster values and skills in their children that prove useful (i.e., *functional*) in their own lives. As a consequence, the children will be well-equipped to thrive in the socio-economic environment they grow up in. Outside of their social-origin, the set of skills and values may be less functional. Additionally, scarcity of resources in the parental household may force parents to adopt parenting practices that demand less emotional, cognitive, temporal, and financial resources. Reduced parental responsiveness to children's emotional, motor, and cognitive developmental needs is likely to impair children's ability to make experiences of contingency and therefore reduces their chances at developing internal control beliefs. A lack of parental responsiveness, erratic parenting, but also too little interest in the child are likely to breed external control beliefs. As a consequence, children from low-SES households are at a greater risk of developing external control beliefs, which depress expected returns to effort and investments in the future. Social inequality is reproduced across generations and the social divide is fastened. Social mobility is undermined not (only) through external barriers, but though an internalized belief system which is self-fulfilling and self-enhancing.

From a rational choice perspective, constrained resources and parents' bounded rationality (Simon, 1955) with regard to the skills, characteristics and values that are most useful lead to sub-optimal investment choices. From a cultural evolution perspective, one could say that the rules of imitation in place have a strong context bias: Children are likely to hold locus of control orientations that they observe in their close environment. However, causes of imitation that derive from the *social relation between the source and the adopter* rather than the expected payoff are not logical (Tarde, 1903).

What are the consequences of these mechanisms on a societal level? The intergenerational transmission of locus of control believes reproduces and solidifies the social structure. This is particularly the case for fatalistic external control beliefs. As Levenson (1974) pointed out, externality derived from powerful others may be a source of activism and protest. Fatalism, in contrast, suppresses any motivated action. Therefore, fatalism is particularly detrimental, both at the individual as well as the societal level.

Chapter 6

The contribution of locus of control to status reproduction

6.1 Motivation, research aims, and contribution

A large body of evidence connects locus of control to diverse status outcomes (see Chapter 4). At the same time, empirical evidence shows that locus of control is contingent on socio-economic background. This suggests that locus of control may play a role in the intergenerational transmission of social status. To the extent that locus of control is associated with the generation and intergenerational transmission of systematic differences in access to advantage, it should be of interest to sociology. The previous Chapter has laid out the theoretical mechanisms through which socio-economic background affects locus of control and through which locus of control affects status outcomes. To date the relevance of locus of control in the status transmission process has not been tested empirically in a single framework. This chapter sets out to test whether the theoretical channel explicated in 5 exists and whether it plays a substantive role in the intergenerational transmission of social status. If the contribution of locus of control to the process of intergenerational status transmission were substantive, it might provide a lever to reduce the intergenerational persistence in social status and enhance fair equality of opportunity. The chapter also investigates whether the influence of locus of control on SES differs by parental social status in order to identify potential mechanisms of cumulative advantage. The main research questions addressed in this Chapter are therefore:

1. *To what degree is the influence of a person's socio-economic background on her own status mediated via locus of control? (Mediator Hypothesis)*

2. *Does the influence of locus of control on socio-economic status differ by socio-economic background? (Moderator Hypothesis)*

The first question treats locus of control as a dependent, as well as an independent variable in the socio-economic context of a person. It thereby bridges the gap between the two hitherto unconnected strands of literature on locus of control reviewed in Chapter 4.

The second question addresses differential effects of locus of control on status outcomes by socio-economic background. Most of the empirical investigations of the effect of locus of control on particular status outcomes at least implicitly assumed that the effect of locus of control is the same for all individuals. The present Chapter tests this implicit assumption explicitly. If the assumption of equal effects across the socio-economic spectrum is rejected, this may either exacerbate or ameliorate initial socio-economic differences.

Addressing these two questions, this chapter contributes to the sociological literature concerned with the mechanisms underlying processes of social closure. It provides a first empirical approximation of the role of locus of control in the intergenerational transmission of social reproduction. Considering more complex relationships between socio-economic background and locus of control in the status attainment process also contributes to the sociological literature concerned with cumulative advantage. To allow for a better understanding of the importance of locus of control to systematic differences in access to advantage, cognitive abilities serve as a reference point throughout the chapter. As Hsin and Xie (2017, p. 153) point out "[w]hile consensus exists that socio-behavioral skills, such as self-control, social skills, and attention-related capacities, positively predict children's academic outcomes, there is disagreement among policy-makers and academics as to their importance relative to cognitive abilities". This Chapter provides further evidence in this debate.[1]

The research questions above are addressed in a path-analytical empirical framework using structural equation models (SEM). SEM was chosen, as it allows investigating complex relationships between constructs that cannot be observed directly, such as locus of

[1] Since cognitive skills are not part of the central research aim, results on cognitive skills will only be discussed to the extent that they provide a reference for the size of the effects of locus of control.

control and social status. The analyses are based on the BCS70. The BCS70 is one of very view large-scale representative panel studies that measured locus of control early in life and contains rich prospectively measured information on the conditions in which the children grew up, as well as different indicators of status attainment measured throughout adulthood. Measuring childhood conditions before locus of control, and locus of control well ahead of the status outcomes, this data-set provides the opportunity to control for reverse-causation, which might bias studies based on cross-sectional data. Moreover, the prospective measurement of all relevant constructs reduces measurement-error.

6.2 Theory and Hypotheses

The well-documented phenomenon of intergenerational status-transmission serves as a starting point for the present analyses. For most industrialized countries, there is evidence that status attainment is associated with the social status of the family of origin (OECD, 2018). A review of the literature on intergenerational earnings correlations between sons born in the 1960s and 1970s and their fathers covering studies from sixteen countries found that their father's income could explain 10% to 50% of the variation in children's income (Blanden, 2019).[2] In Germany, roughly a fourth of the variation in children's income can be attributed to their fathers' income (Blanden, 2019). Regardless of whether occupations, income, or income ranks are used, status transmission appears to be relatively stable in Europe and the U.S. since the 1950s, at least for men (Breen and Müller, 2020; Chetty et al., 2014; Markussen and Røed, 2020).[3] A simulation by the OECD suggests that in the average OECD country, it takes roughly five generations for an offspring of a family in the first income decile to reach average income (OECD, 2018).[4]

Academic interest in status transmission shifted from documentation to explanation in the 1960s. Greater attention was given to the *process* underlying status attainment, and parental social status became one of a more diverse set of factors influencing status attainment Haller and Portes (1973). Path analysis and structural equation modeling

[2]The younger generation must have reached the climax of their careers, such that their income paths would have stabilized. This can be expected for the birth-cohorts included in this literature survey.

[3]Some even find that intergenerational mobility in the U.S. decreased over the last decades (Davis and Mazumander, 2017; Song et al., 2020).

[4]The country with the greatest mobility according to this simulation Denmark, where moving up from the lowest income decile to average income is predicted to be possible within two generations. The prediction for Germany is six generations. The countries with the lowest estimated earnings mobility are South Africa and Brazil (9 generations) and Columbia (11 generations).

advanced to the method of choice for this type of analysis (Duncan, 1966; Hauser and Goldberger, 1971). Both methods allow the simultaneous testing of hypotheses containing different dependent variables. Structural equation modeling has the added benefit of reducing measurement error by approximating latent constructs through more than one indicator variable.

Two influential contributions in this literature were provided by Blau et al. (1967) and Sewell et al. (1969). Blau-Duncan(1967) established education as a main mediator in the status transmission process. According to their theory, parental position, directly and indirectly, affects occupational attainment via educational attainments and the first-job. The model by Sewell et al. (1969), also known as the '*Wisconsin Social Psychological of Status Attainment*'. Sewell and Hauser (1993), built upon the work by Blau et al. (1967) but extended it in two directions. Firstly, it included influences from actors outside the family context, such as teachers and peers. Secondly, it included measured ability and educational and occupational aspirations to predict status attainment. In the Wisconsin model "[a]spirations are seen as a central mechanism in the process. They are formed and modified in social interaction" (Otto and Haller, 1979, p. 888). Moreover, the social origin was disaggregated to include parental educational levels, occupational status and income, and own income was added as a dependent variable (Sewell and Hauser, 1972, 1975). Since the initial theoretical contributions, a large body of literature has provided evidence that corroborates the causal paths hypothesized in both models (Otto and Haller, 1979).

This research project is located in the tradition of these path-analytical investigations of the process that underlies the intergenerational transmission of social inequality. In line with the Blau-Duncan (1967) occupational status and wages are assumed to be mediated via educational attainment. In line with the Wisconsin Models, a social-psychological mechanism is posited at the center of the transmission process. In contrast to the original path-analytical analyses, the aim is not to find the most parsimonious mechanism to predict later status attainment. The aim is rather to investigate the relative contribution of a single social-psychological variable - locus of control - to the transmission of social status. The question to be answered is: *How much of the association between children's status attainment and their parents' social status can be attributed to locus of control?*

6.2.1 Hypotheses on mediation

The central hypothesis to be tested is whether and to what degree locus of control mediates the influence of a person's socio-economic background on their own socio-economic status. Partial mediation is assumed as there are other channels through which parental social status may affect status attainment (e.g. cognitive ability or aspirations).

> `H1`: *Locus of control partly mediates the influence of a person's socio-economic background on their own status attainment.*

For this hypothesis to hold, two associations are required: Firstly, socio-economic background needs to significantly affect locus of control (H1a). Secondly, locus of control needs to affect status outcomes in a significant way (H1b). Partial mediation means that a direct effect of parental social status on own status attainment (i.e., capturing all direct and non-direct effects which are not mediated through locus of control) are expected.

Theoretical arguments in favor of an association between parental social status and children's locus of control orientations (H1a) have already been discussed at some lengths in Chapter 5.3. The theoretical arguments presented therein predict children from less privileged backgrounds to be more prone to make experiences that undermine internal control beliefs and promote external control beliefs.

> `H1a`: *Children from high-SES households have a more internal (less external) locus of control than children from low-SES households.*

Chapter 5.1 discussed why locus of control is likely to affect status relevant outcomes. A more internal locus of control orientation sets the stage for higher levels of effort and the choice of more difficult tasks due to higher expected rates of return to effort and investments in the future. Since higher levels of effort and the choice of more complex tasks are typically remunerated in meritocratic societies, higher levels of internal locus of control are expected to be associated with higher social status.[5] Externality, in contrast, undermines effort by reducing the perceived association between effort and outcome.

> `H1b`: *Internal (external) locus of control has a positive (negative) effect on social status.*

[5]Within Heckman's theory of skill-formation framework the expected outcome increases with skill level and effort, which in turn increases with the expected return to effort. Expected return to effort is (on average) higher when locus of control is internal than when it is external.

Jointly, the social contingency of control convictions and the relevance of locus of control for status outcomes imply that locus of control may mediate the influence of parental social background on status attainment. Given that there are other mediators of parental status, such as those proposed by the Wisconsin Model (Sewell and Hauser, 1972), partial mediation is assumed.

> `H1c`: *Socio-economic background maintains a direct effect on children's status outcomes.*

All of the aforementioned auxiliary hypotheses (`H1a - H1c`) need to be tested in a joint framework to test the hypothesis on partial mediation (`H1`) formulated above. To better understand the size of the effect of locus of control, the same mediation mechanism is tested for cognitive abilities. Doing so is supposed to provide a frame of reference against which the size of the effect of locus of control can be compared.

6.2.2 Hypotheses on moderation

"Although most research on SES and child outcomes has focused on mediating processes, it is generally acknowledged that these processes are not the same for all children (McLoyd 1998, Wills et al. 1995). For any given mediator model, certain characteristics of children and certain environmental conditions serve as moderators (Wachs 2000)" (Bradley and Corwyn, 2002, p. 387). Moderation occurs if the strength (and direction) of the association between an independent variable and a dependent variable varies with a third variable - the moderator (Aiken et al., 2003; Baron and Kenny, 1986). Moderation is typically tested by *interaction* effects.[6] Socio-economic background might be such a moderator in the status attainment process. Social background may not only affect locus of control itself but also the returns to a particular locus of control orientation.

Two competing hypotheses on the interaction of socio-economic background and locus of control in the status attainment process can be deducted from the existing literature on status attainment:

The *'theory of cumulative advantage'* by Blau et al. (1967) holds that status variables may have direct and persisting interaction effects with other variables, which lead to group

[6]In linear regression and path models, interaction effects are operationalized by adding a multiplicative term between the independent variable and the moderator to the estimation equation.

differences in the returns to socio-economic resources (DiPrete and Eirich, 2006).[7] Status variables may be any variables that can be conceptualized as (long-term) exposure to a particular treatment, such as growing up in a poor versus a wealthy family or in a single-parent household (DiPrete and Eirich, 2006). The theory of cumulative advantage in the 'Duncan-and-Blau sense' thus would suggest that the return to locus of control may differ among status groups. The reasoning is that the potency of locus of control orientations increases with the presence of other types of resources. Locus of control is likely to unfold its full potential well it falls on a 'fertile soil'. The positive effects of a strong internal (low external) locus of control orientation may increase with the degree to which other forms of capital (financial, social, or cultural) are present. In other words, individuals from privileged socio-economic backgrounds are expected to benefit more from an internal (less external) control orientation.[8] In this case, socio-economic background and locus of control are assumed to be complements in status attainment production. The expected direction of the interaction term is positive.

> `H2a:` *The positive (negative) effect of an internal (external) locus of control orientation on social status attainment increases with the initial parental social status. (Fertile Soil Hypothesis)*

The *'theory of resource substitution'* proposed by Mirowsky and Ross (2003); Ross and Mirowsky (2011), in contrast, suggests that each resource's relative importance decreases as the number of available resources increases. A persons' socio-economic status, as well as her locus of control orientation, can be conceptualized as resources that can be utilized in the status attainment process. According to the theory of research substitution, the relative importance of locus of control in the status attainment process would be lower for individuals from a higher socio-economic background. For individuals from low socio-economic backgrounds, internality is expected to be more important, as these individuals

[7]DiPrete and Eirich (2006) distinguish the theory of cumulative advantage in the 'Duncan and Blau sense' from the Mertonian theory of cumulative advantage (Merton, 1988, 1995) which relates to the phenomenon that current levels of a particular resource have a direct causal relationship with future levels of the resource and returns to the resource. This type of cumulative disadvantage will be discussed in more detail shortly.

[8]An illustrative example might be helpful here: Imagine two individuals. Both have a high internal locus of control orientation. One of them is highly educated and the child of a local doctor and high-school teacher. The other dropped out of school at the age of 15 without a school degree and is the child of two unemployed parents. Both start their own businesses. Due to the different kinds of services they can provide because of their education and the other types of resources, their parents may be able to provide, the highly educated person is likely to get a higher return to their locus of control than the person who dropped out of school.

have fewer alternative resources to fall back on.[9] Socio-economic background and locus of control are assumed to compensate each other in the production of status attainment. The expected direction of the interaction term is negative.

> `H2b`: *The positive (negative) effect of an internal (external) locus of control orientation on social status attainment decreases with the initial social status. (Resource Substitution Hypothesis)*

In case both hypotheses above are rejected, socio-economic background and locus of control would be independent inputs in the status attainment process.

6.2.3 Joint effects of mediation and moderation

"[T]he connection between mediators and moderators is often tighter (i.e., more fundamental) than may be initially apparent" (Bradley and Corwyn, 2002, p. 387). Although Baron and Kenny (1986) went to great lengths to point out the distinctions between mediators and moderators, they also discussed how each often implicates the other."[10] Various versions of moderated mediation, i.e., a mediation that is moderated, have been discussed in the literature (Hayes, 2013; Muller et al., 2005; Preacher et al., 2007).[11] Part of the academic discussion is whether a mediator can at the same time be a moderator. While some argue that this is conceptually not possible (Jacoby and Sassenberg, 2011) others maintain that it is possible if an intertemporal perspective is adopted (Karazsia and Berlin, 2018). Karazsia and Berlin (2018), for example, have argued that a construct that initially mediates a certain relationship may evolve into a moderator over time.

What does it mean if mediation and moderation occur together? The answer two this question depends on the direction of the interaction effect. Ross et al. (2001) coined the

[9] Another illustrative example: Imagine an individual with a business idea and a strongly internal locus of control. In the presence of other types of resources, the business idea could be realized more readily than in their absence. A much lower degree of internal locus of control might then be required to take the actions to start the business. In the absence of further resources, the internal locus of control might drive the person to acquire these resources first in order to be able to start the business. A much higher degree of internal locus of control might be required to take all the necessary actions and not get disappointed along the way.

[10] In their review of the association between socio-economic background and health outcomes Taylor and Seeman (1999) identified several individual characteristics, including locus of control, self-esteem, and dispositional optimism as potential moderators of the association, emphasizing that the same variables may also partially mediate the relationship between SES and health.

[11] Mediated moderation (i.e., a moderation effect that is mediated via another variable) is not meaningful, according to Hayes (2013), since the product of an independent variable with a moderator does not have a useful meaning. Muller et al. (2005) do, however, discuss mediated moderation and provide examples.

term *'structural amplification'* to describe the special case of mediation and moderation occurring jointly in the moderator amplifies the undesirable effects of structural conditions. Structural amplification arises if the moderator of an association between a structural condition and a specific outcome is itself a consequence of the structural condition and simultaneously a determinant of the outcome Ross and Mirowsky (2011). Hence, structural amplification would be an instance of moderated mediation, where the mediator is at the same time a moderator. Although this definition of structural amplification includes all moderation effects that exacerbate undesirable effects of structural conditions, Ross and Mirowsky (2011) uses the term only for moderation effects that are *compensatory*. In this case, "social conditions decrease the likelihood of attaining personal resources that otherwise would moderate the condition's undesirable consequences" (Ross and Mirowsky, 2011, 592). In the present case, structural amplification would hold if children from low socio-economic backgrounds have less chance to obtain those locus of control orientations that they would need to compensate for the undesirable consequences of their low social background on status attainment. As Ross (2011, p. 288) put it: "the very thing needed to protect disadvantaged [groups] from the negative effects of their environment - a sense of personal control - is eroded by that environment". The consequence is social closure. The literature reviewed in Chapter 4 indicates that more internal (less external) locus of control may compensate for a low socio-economic background. A the same time, low socio-economic background tends to result in less internal (more external) locus of control orientations. Consequently, group differences in status attainment cannot be reduced because the mediation of status attainment through locus of control obstructs the compensatory mechanism that locus of control might otherwise provide.

Structural amplification may also result from *complementary* moderation. In this case, social conditions decrease the likelihood of attaining personal resources that otherwise would allow a more beneficial utilization of available socio-economic resources. The consequence is increasing social inequality because one social group can capitalize their social background even more efficiently. The mediation process leads to group differences in cumulative advantage.[12] Applied to the present case, this means that children from low socio-economic backgrounds are less likely to obtain a strongly internal (low external) locus

[12]Note that this form of structural amplification could be considered a combination of cumulative (dis)advantage in the Blau-Duncan sense and the Metonian sense, as it combines persistent group differences with increasing returns to a particular resource over time.

of control, which would allow them to capitalize the available resources more efficiently.

If mediation and moderation exist jointly, as suggested above, social closure or even increasing socio-economic inequality between generations may theoretically obtain. Therefore an empirical investigation of the hypothesized phenomena is of sociological interest.

6.3 Evidence from related research

Empirical evidence on social-class differences in locus of control, on the one hand, and on the association of locus of control with several status outcomes, on the other, has already been discussed in Chapter 4. This section focuses on empirical investigations that consider locus of control, or related concepts, as mediators or moderators in the status attainment process.

Three studies are particularly interesting due to their closeness in theoretical and methodological approach. Moreover, they are also based on data from the U.K. This shared institutional setting facilitates comparing results.

The study that is most closely related is one by Blanden et al. (2007) that is also based on the British Cohort Study 1970. Blanden et al. (2007) estimated the importance of socio-emotional skills and cognitive abilities in intergenerational income persistence. Locus of control had the strongest relation to parental income, in their extensive battery of of socio-emotional skills. At the same time, locus of control had a significant effect on earnings at 30, controlling for a large number of other cognitive and non-cognitive abilities and standard control variables in earnings regressions, such as educational attainment and labor market experience. They find that socio-emotional skills account for 19% of intergenerational income coefficient whereas cognitive skills accounted for 27%.

The second study investigated whether locus of control mediates or moderates the influence of parental socio-economic status on time spent in NEET between the age of sixteen and twenty (Ng-Knight and Schoon, 2017a). The analyses are based on data from the Longitudinal Study of Young People in England (LSYPE). This panel study followed over 15.000 young individuals born in 1989/1990 from age 14 into their early twenties. The authors did not find locus of control at the age of 14 to be significantly associated with socio-economic background.[13] However, locus of control and socio-economic background

[13] The discussion in Section 6.7 will discuss potential reasons for this null-finding in greater detail.

were found to affect time in NEET. Ng-Knight and Schoon (2017a) concluded that locus of control does not mediate the influence of social status on time in NEET. Concerning moderation, their results indicate that locus of control may compensate for adverse socio-economic background up to a certain degree. Internal locus of control was found to decrease the positive association between low socio-economic background and time spent NEET, but not for those who were in NEET for six months or more. The authors infer that a feeling of agency can protect against socio-economic risk, but only when the risk factors are not overpowering (Ng-Knight and Schoon, 2017a).

The third study, which is based on the BCS70, uses structural equation modeling to investigate the degree to which parental socio-economic status, childhood intelligence, problematic behavior, locus of control, and self-esteem affect educational and occupational attainment measured at the age 30 (von Stumm et al., 2009). The findings indicate that an increase in (internal) locus of control by one standard deviation (SD) increases the odds of attaining the highest occupational class (professionals and managers of large institutions) by 1.12, controlling for parental social status, educational attainment, and a general intelligence factor.[14] Self-esteem did not predict occupational attainment once parental background, education, and intelligence were held constant. Further path analyses showed that the influence of locus of control on status attainment is entirely mediated through educational attainment. For comparison, cognitive ability and behavioral disturbances were found to maintain a direct effect on social class in addition to the indirect effect via education. Mediation was not directly tested, as the authors treated socio-economic background, locus of control, intelligence, and behavioral disturbances as correlated exogenous variables. Locus of control and socio-economic background were significantly positively correlated, however.

There are also some studies that tested the mediating and moderating role of other socio-emotional characteristics on status attainment. Hsin and Xie (2017) investigated the relative importance of a broad set of socio-emotional skills[15] and cognitive ability as mediators of parental social status on educational attainment using U.S. data on over 9600 children between kindergarten and eighth-grade. They found that cognitive skills

[14]The odds ratios for equivalent changes in parental social class, education, and intelligence were 1.25, 1.82, and 1.54.

[15]The authors use the Social Rating Scale as an indicator of socio-emotional skills. The Social Rating Scale rates students according to their approach to learning, self-control, interpersonal skills, as well as externalizing vs. internalizing problem behavior.

mediate a larger share of the influence of family background on educational attainment than socio-emotional skills. Cognitive skills mediate about five times more of the influence of mothers' education or permanent income than socio-emotional skills. They also found that the mediation effect of socio-emotional skills increases over time while that of cognitive skills remains constant.

Focusing on the Big Five as potential moderators of the influence of social status on educational attainment Shanahan et al. (2014) found that higher levels of Agreeableness, Openness, Extroversion, and Emotional Stability could compensate the harmfull effects of low socio-economic origins on educational attainment to some extent. A very similar study by Damian et al. (2015) also investigated the Big Five, but included income and occupational status as additional outcomes variables. The study by Damian et al. (2015) also controlled for cognitive ability and thus allows comparing the effects of personality with those of cognitive abilities. Damian et al. (2015) found higher levels of Extraversion, Agreeableness, and Conscientiousness to compensate adverse effects of low socio-economic background on educational attainment, as long as parental SES and cognitive abilities were not allowed to interact. Conscientiousness continued to compensate the effects of a low social background on annual income, even after controlling for cognitive ability and their interaction with parental SES. For occupational class, the initially found mitigating effect of Extraversion disappeared when cognitive ability was included in the model.

The mediating role of cognitive skills in the intergenerational transmission of social status is more established (Deary et al., 2005; Griliches and Mason, 1972; Hauser et al., 1983; Jencks, 1979). Studies on moderation are more scarce, but the evidence supports a resource substitution effect (Johnson et al., 2006). Damian et al. (2015) found that higher cognitive skills may compensate the harmful effects of a low socio-economic background on income. aAt the same time, the positive effects of higher levels of cognitive abilities on educational and occupational outcomes are found to be even stronger in high-SES families.

6.4 Method

Structural equation modeling (SEM) is used to test the hypotheses formulated above. The main reason for this choice is that SEM allows the simultaneous estimation of complex relationships between theoretical constructs that cannot be observed and identified by a single variable. This section briefly introduces SEM and discusses why this method is considered appropriate for the questions at hand.

Structural equation models contain a measurement part and a structural part (Hayes, 2013). The *measurement part* comprises a measurement model for each latent construct in the structural part. Latent constructs are constructs that cannot be observed directly. Each measurement model predicts a latent construct from several observed indicator variables by isolating the indicator variables' shared variance from the variance-covariance matrix of the indicator variables. This way of operationalizing latent constructs has significant advantages. Deriving the relative weights of the different indicator variables from their variance-covariance matrix provides an empirically driven alternative to more or less arbitrary choices on the relative importance of these indicators or cutoff values for group membership by the researcher. Moreover, multidimensional constructs can be operationalized using a single latent variable.[16] As a consequence, measurement error in latent constructs is reduced[17]. More precise measurement of latent constructs is also likely to improve the precision of the the estimates when the latent constructs are used as dependent or independent variables in the structural part of the model. The *structural part* comprises a system of equations representing the relationships between several dependent variables, some of which may be latent constructs. This means that the same variable or latent construct can be a dependent variable in one equation and a predictor variable in another equation. Both characteristics are relevant to the present analyses:

Locus of control, socio-economic status, and cognitive abilities are not directly observable. Measurement models are used to obtain reliable and valid latent indicators of these theoretical constructs. Socio-economic status is not directly observable because it is multidimensional in nature. Socio-economic status cannot be captured adequately by a single indicator such as education, income, occupation, or the number of theater visits last month. While all of these variables are indicators of social status, they *are* not social status. If

[16] Single indicators of multidimensional constructs can be constructed in other ways. Examples for such alternatives are simple or weighted sums after creating binary or categorical groups for each indicator. In this case, the researcher has to make some decisions with regards to the relative weight of the dimension or the cut-off values for group membership. Choices for such cut-offs or weights then need to be well-justified by the researcher.

[17] Assuming the indicator variables are suitable to measure the latent construct.

inferences about general social status rather than single indicators of it are to be made this multidimensionality should be taken into account. Conceptually socio-economic status is a *formative* rather than a *reflective* latent construct (Hauser, 1972; Hauser and Goldberger, 1971). Considering the numerous methodological caveats put forward against formative measurement of latent constructs (Bollen, 2011; Bollen and Bauldry, 2011; Edwards, 2011; Hardin and Marcoulides, 2011), it is, nevertheless, treated as a reflective construct in the present study.

A graphical representation of the theoretical model underlying structural part of the model is provided in Figure 6.1. The system of equations that underlies the structural part of the model is expressed in Equations 6.1 - 6.4 below. The structural model investigates the association between socio-economic background and different indicators of status attainment, namely educational attainment, occupational class and income (*Direct Effect*). Mediation is tested by investing whether locus of control and cognitive ability are associated with parental social status and with own status attainment (*Mediation*). Moreover, parts of the influence of parents' social status on the child's occupational class and income are assumed to be mediated by the child's educational attainment. Finally the structural model investigates whether and to what extent the effects of locus of control and cognitive skills on status outcomes differ by socio-economic background (*Moderation*).

$$LoC_i = \gamma_0 + \gamma_1\, SEB_i + \gamma_2{}' x_i + e_{i1} \tag{6.1}$$

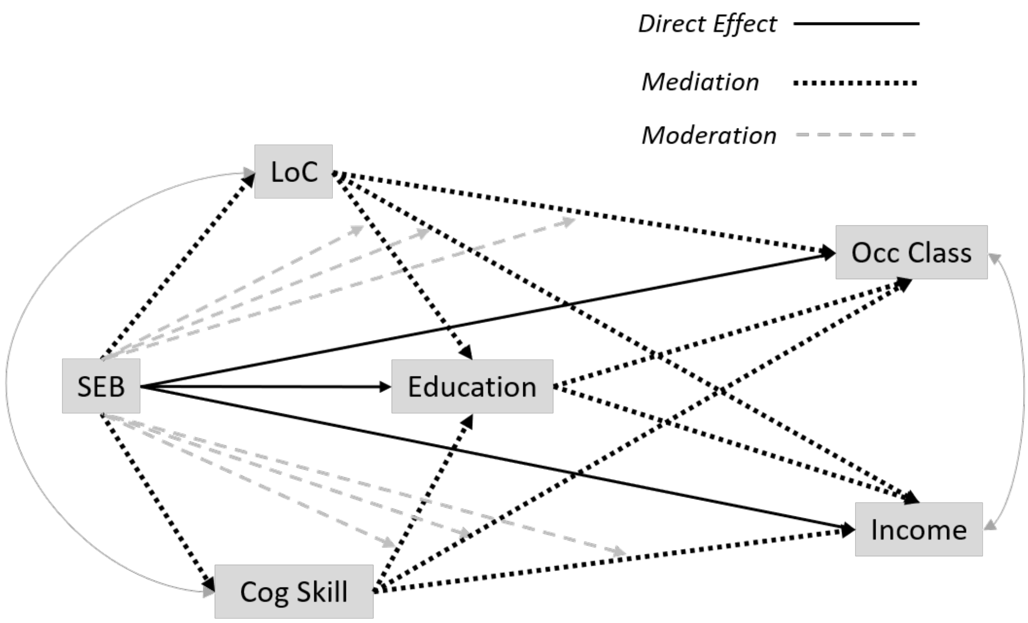
$$CogSkill_i = \delta_0 + \delta_1\, SEB_i + \delta_2{}' x_i + e_{i2} \tag{6.2}$$

$$\begin{aligned} Edu_i =& \alpha_0 + \alpha_1\, LoC_i + \alpha_2\, SEB_i + \alpha_3\, LoC_i * SEB_i + \\ &+ \alpha_4\, CogSkill_i + \alpha_5\, CogSkill_i * SEB_i + \boldsymbol{\alpha_6}{}'\mathbf{x_i} + e_{i3} \end{aligned} \tag{6.3}$$

$$\begin{aligned} SES_{ik} =& \beta_{k0} + \beta_{k1}\, LoC_i + \beta_{k2}\, Edu_i + \beta_{k3}\, SEB_i + \beta_{k4}\, LoC_i * SEB_i + \\ &+ \beta_{k5}\, CogSkill_i + \beta_{k6}\, CogSkill_i * SEB_i + \boldsymbol{\beta_{k7}}{}'\mathbf{x_i} + e_{ki} \end{aligned} \tag{6.4}$$

In Equation 1.4 k is either logged gross hourly wages or occupational status. Equations 6.1 and 6.2 test to what extent locus of control and cognitive skills depend on social

Figure 6.1: Theoretical path model



Note: The figure contains a graphical representation of the theoretical model underlying the structural part of model. In the structural model, moderation is operationalized by interacting locus of control with SEB and cognitive skills with SEB respectively.
Source: Own illustration,

background and a number of covariates. Equation 6.3 tests whether, and to what extent, locus of control and cognitive skills mediate the effect of social background on education, and whether the effect of the mediating variables differs by social background. Equation 6.4 does the same for wages and occupational status but allowing an additional channel of mediation through education. Error terms of the individual equations are assumed to be uncorrelated. For locus of control to mediate the influence of socio-economic background on own education, γ_1 from Equation 6.1, α_1 from Equation 6.3 need to be statistically significant. For locus of control to mediate the influence of socio-economic background on income or occupational status, γ_1 from Equation 6.1, $\beta_k 1$ from Equation 6.4 need to be significant. For a moderation effect on income and occupational status to be present, $\beta_k 4$ in Equation 6.4 additionally needs to be significant. For locus of control to moderate the influence of social background on educational attainment α_3 from Equation 6.3 needs to be significant, in addition to α_1 and γ_1. For a moderation effect on occupational attainment and wages β_{k4} needs to be statistically significant.

$$Cov(LoC_i CogSkill_i) \neq 0 \tag{6.5}$$

Cognitive skills and locus of control are assumed to be correlated. The covariance between locus of control and cognitive skills is introduced as there might be other factors besides socio-economic background, which influence these two variables. Examples for such factors might be influences outside of the parental household such as schools, peers, the neighborhood but also genetic factors. No assumptions about a potential causal direction of the association between cognitive skills and locus of control are made.

Interaction terms for testing the moderation hypothesis were constructed using the Unconstrained Product Indicator (UPI) method. The upside of this choice is that the UPI method (Coenders et al., 2008) does not require indicator variables to be normally distributed. The downside of this method is that it only allows continuous or numeric indicator variables. Given that the indicator variables for locus of control are measured on a three-item scale, model fit is necessarily reduced when the unconstrained product indicator (UPI) method is used. The alternative Latent Moderated Structure (LMS) method developed by Klein and Moosbrugger (2000) would allow for ordinal indicator variables but has been shown to be biased under moderate and more severe violations of normality (Cham et al., 2012; Coenders et al., 2008; Marsh et al., 2004; Maslowsky et al., 2015). The UPI method, in contrast, has been shown to provide unbiased estimates even under relatively severe violations of normality (Cham et al., 2012; Coenders et al., 2008; Marsh et al., 2004). Hence, a choice had to be made between a potentially insufficient model fit and inefficient but unbiased estimation (the UPI method), and a good model fit and efficient estimation but potentially biased point estimates (the LMS method). Considering that the probability of a Type I error and the bias of the estimated coefficient for the latent interaction has been shown to be relatively severe under the LMS method[18], a less biased estimation (i.e., the UPI method) is chosen over efficiency and model fit.[19] Standard errors and test statistics robust to non-normality are used in all analyses (MLR option in Mplus). Product indicators have been formed by matching indicators by reliability as suggested by

[18]For indicator variables with a median skewness of 0.9 and kurtosis of 1.1Coenders et al. (2008) shows to the latent interaction coefficient to be overestimated by 8%. For a median skewness of 2 and median kurtosis of 6 in the observable indicators, the coefficient estimate for the latent interaction is overestimated by up to 400% (Cham et al., 2012). Maslowsky et al. (2015) also shows that for latent variables that are chi-square distributed, the type 1 error for the latent interaction is up to 30%.

[19]Estimates using the LMS method have also been obtained and are available from the author upon request. Results for the interaction effects were significant under the LMS method. Given the skewness in the indicator variables, however, these results are very likely severely biased.

Marsh et al. (2004); Wu et al. (2013). To do so, the indicators of both latent variables are sorted by reliability and the most reliable indicators of the larger scale are multiplied with those of the smaller scale (in this case, SEB). Several simulation studies indicate that this method yields unbiased and efficient estimates for the interaction coefficient for sufficiently large sample sizes (N > 500), which is given in the present case (Cham et al., 2012; Coenders et al., 2008; Jackman et al., 2011).[20] Since both latent interaction factors are based on indicators of socio-economic background, error covariance parameters for overlapping products of indicator pairs are also included in the structural model (Bodlaj et al., 2012).

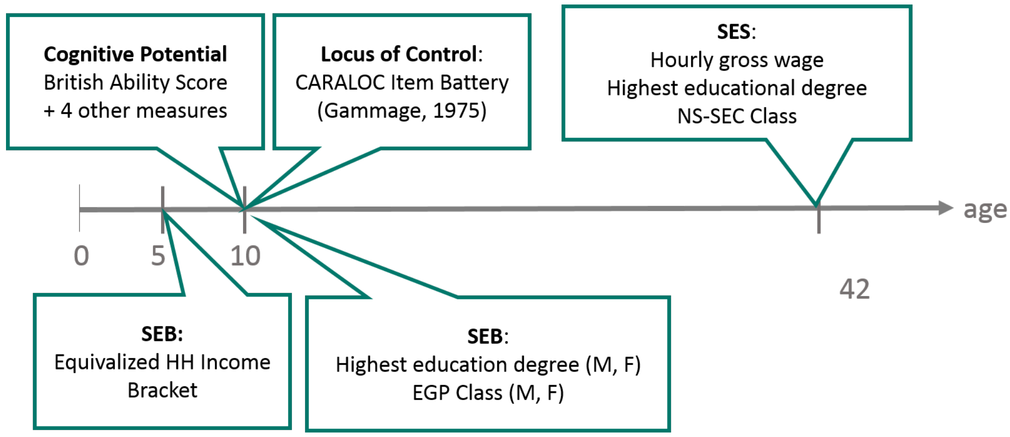
Sex and migration background have been included as covariates, since there is evidence showing that females tend to have lower internal (more external) control beliefs whereas individuals with migration background tend to be more internal. Single parenthood was included as there is some evidence that the presence of a father figure in early childhood is significantly related to the development of internal control convictions (Duke and Lancaster, 1976; Elkins and Schurer, 2020).

Full Information Maximum Likelihood (FIML) is used to handle item missingness in all models. FIML outperforms listwise deletion under the assumption that data are missing at random given the observed covariates (Little, 2012). Cham et al. (2017) show that the use of FIML together with the UPI method yields unbiased estimates for the coefficients of the latent interaction for non-normally distributed indicator variables if missingness of the indicator variables is completely at random.[21] Estimates are obtained using MPlus8.

[20] Cham et al. (2017) points out that these simulation studies assume that all indicator variables are completely observed.

[21] When the indicators are MAR, CPI and UPI lead to biased $\gamma 3$ estimates in all indicator distribution conditions. The bias increases with the fraction of missing data (Cham et al., 2017, p. 16). Using FIML with the LMS method produces biased estimates for the coefficient of the interaction term when the distributional assumption of normally distributed indicator variables are not given (Cham et al., 2012). Since normality of the indicator variables is certainly not given, UPI was chosen over LMS, even though the assumption that indicator variables are missing completely at random is very strong. At least with regards to the parental socio-economic status, this assumption is not very likely to be fulfilled. Instead, it is likely that the missingness of data is associated with the latent variable of parental status. Unfortunately, the simulation study by Cham (2017) only tests normally distributed indicator variables. A simulation study comparing the performance of using FIML with LMS or a simulation of the UPI method that considers non-normally distributed indicator variables is not known to the author - therefore, it is difficult to know which method would avoid bias best.

Figure 6.2: Time of measurement of core concepts



Note: The figure shows at which age of the respondent the core concepts were measured
Source: Own illustration.

6.5 Data, operationalization of core concepts and weighting strategy

6.5.1 Data source

The data for the empirical analyses come from the 1970 British Cohort Study. The BSC70 is an ongoing longitudinal study that tracks individuals from England, Scotland, Wales, and Northern Ireland born in a particular week in April 1970. The initial sample contained approximately 98% of all notified births in Great Britain during this week (17,195 individuals). Further information was collected in eight follow up surveys. The present paper uses information from the surveys conducted in the base year and at the ages of 5, 10, and 42 (University Of London, Institute Of Education, 2016). The data-set is restricted to individuals for whom panel attrition weights could be constructed. Individuals who entered the sample after the first wave are therefore not included.[22] The resulting unbalanced sample contains 8,903 individuals. Sample summary statistics are presented in Table 6.1.

6.5.2 Operationalization of core concepts

Status Attainment (SES): SES is measured at the age of 42 using three separate status indicators: educational attainment, occupational status, and gross hourly wages. Educational attainment is measured by the highest educational grade achieved by the age

[22] A sample of individuals born in 1970 who immigrated to the UK at a later age was added to the sample later.

of 42.[23] Occupational status is measured by a simplified version of the socio-economic group (SEG) indicator. The SEG classification incorporates occupation and employment status and aims "to bring together people with jobs of similar social and economic status" (Rose et al., 2005, p.9). SEG groups were collapsed as indicated in Table A.1 to render the classification more similar to Goldthorpe's class scheme (Erikson et al., 1982; Goldthorpe et al., 1987). Gross hourly wage is derived from the gross amount of payment the study participant receives weekly divided by the usual weekly working hours. Individuals who reported to work more than eighty or less than five hours per week, and individuals with an hourly wage below 1.5 were excluded. Twelve individuals who reported earning more than 120 per hour were top-coded at 120.

Socio-economic Background (SEB): The operationalization of socio-economic background deviates from the traditional Blau-Duncan model by including status indicators of mothers', and by constructing a single indicator of socio-economic background rather than reporting the effects of parental education and occupation separately.[24] While the choice of a single indicator of SEB obscures the relative importance of different types of resources (e.g., income vs. education) and their bearers (mother vs. father), it serves to facilitate the model and restricts the number of paths to be estimated, which is limited by the number of observations in the data-set. Consistent with the resource-based definition of social class in the theory chapter, the indicator of socio-economic background operationalizes central resources in the socialization process. Socio-economic background is indicated by a latent variable consisting of the highest paternal and maternal levels of education and parental occupational class when the study participant was five and equivalenced household-income when the study participant was ten years old.[25] Occupational class is measured on the same modified SEG scale as above. An overview of the scales of all variables is provided in Appendix A.1. Exploratory factor analysis supports a single factor with an eigenvalue of 1.98. Cronbach's alpha reaches 0.80 and could not be improved by dropping any of the items. The principal component explains 0.55 of the variance in the indicator variables.

[23] The few participants who obtained a low graded GCSE degree were recorded to have the same educational level as those who obtained a low-grade Certificate of Secondary Education (CSES). The GCSE degree was introduced after most of the study participants had already finished their education, such that only very few participants obtained GCSEs.

[24] The approach to measuring status of origin is more aligned with the approach taken by the Wisconsin social-psychological model of status attainment (Sewell and Hauser, 1975).

[25] Household income is only provided in income-brackets by the BCS70, such that equivalenced household income is based on the mean of these income brackets divided by the respective EUROSTAT Equivalence Scale for the household.

Locus of Control (LoC): Prior work on development and stability of control convictions indicates that locus of control is contingent on prior experiences, some of which may also be relevant in the construal of a person's social status (Cobb-Clark and Schurer, 2013; Goldsmith et al., 1996; Gottschalk, 2005).

To obtain an unbiased estimation of the coefficient for locus of control that does not capture the effects of prior achievements, early measurement of locus of control is necessary. Therefore the earliest possible measure of locus of control at age ten is utilized. The measure is based on the CARALOC scale developed by Gammage (1975). It contains 16 items from established locus of control scales and was designed to measure children's perceived achievement control, focusing on schooling. The full set of items is listed in Table A.1 in the Appendix. Answers are recorded on a three-point indicator scale (Yes, Don't know, No) where higher scores indicate higher levels of internality. Exploratory factor analysis on the original sample of 10 year-olds confirms that the items (excluding filler items) load on a single factor with an eigenvalue of 2.01 with a Cronbach's alpha of 0.62, falling short of conventional threshold levels. Excluding further items (marked as excluded in Table A.1) increases Cronbach's alpha to 0.69.[26] The final nine items load on a single factor with an Eigenvalue of 1.96, and the proportion of variance explained by the principal component is 25% (as compared to 17% with the original set of items).[27]

Cognitive Ability: Cognitive ability is measured at the age of ten as the principal component of eight different indicators of cognitive ability, including the Shortened Edinburgh Reading Test, the Friendly Maths tests, the four British Ability Scales (word definitions, recall of digits, similarities, and matrices), the CHES Pictorial Language Comprehension, and a spelling test.[28] A preliminary exploratory factor analysis confirmed a single factor that satisfies the Kaiser Criterion with an Eigenvalue of 4.2. Cronbach's alpha for the indicators of cognitive skills on the full age 10 sample is 0.89. If a principal component were extracted, it would explain 58% of the variance in the indicators.

[26] Other papers using the CARALOC in the BCS70 also chose to exclude items in order to obtain a more consistent scale (von Stumm et al., 2009)

[27] The nine items finally included in the measurement of control convictions are printed in boldface in Table A.1.

[28] Results for the individual test results were obtained using SPSS code provided by Parsons (2014).

Table 6.1: Summary Statistics

	count	mean	sd	min	max	p50	skewness	kurtosis
Study Person Information								
single mother	8767	0.06	0.23	0.00	1.00	0.00	3.84	15.75
gender	8903	0.52	0.50	0.00	1.00	1.00	-0.07	1.00
migration background	8903	0.08	0.26	0.00	1.00	0.00	3.20	11.27
hourly Wages	2583	14.55	12.18	1.54	120.00	11.54	4.74	35.17
hourly Wages (logged)	2583	2.49	0.56	0.43	4.79	2.45	0.74	4.52
Education (BD9HACHQ)	8903	2.28	2.02	0.00	6.00	2.00	0.34	1.72
Education alt. Dev. (BD9HANVQ)	8903	2.04	1.69	0.00	5.00	2.00	0.11	1.59
Occ Status (revGold_42)	7511	4.63	1.89	1.00	7.00	5.00	-0.68	2.30
Occ Status al. Dev. (B9CNS8)	7717	3.46	2.02	1.00	8.00	3.00	0.57	2.13
Occ Status al. Dev. (B9CSC)	7486	4.07	1.23	1.00	6.00	4.00	-0.60	2.36
Information on Parents								
Parental income brackets (BD3INC)	7241	4.01	1.25	1.00	7.00	4.00	0.49	3.31
Parenal Income (Inc_P)	7197	55.71	30.21	4.49	230.77	51.87	1.20	4.74
Mother's Education (e189a)	7252	1.91	1.21	1.00	5.00	1.00	1.09	3.07
Father's Education (e189b)	6772	2.32	1.51	1.00	5.00	2.00	0.68	1.97
Father's Occ Status	6950	3.66	2.06	1.00	7.00	3.00	0.33	1.71
Mother's Occ Status	5568	3.33	2.11	1.00	7.00	4.00	-0.02	1.25
Father's Occ Status alt. Def. (e197)	7174	3.48	1.26	1.00	6.00	3.00	0.32	2.44
Mother's Occ Status alt. Def. (e206)	2853	3.10	1.32	1.00	6.00	3.00	0.04	1.73
LoC Indicators								
LoC1 (k075)	7142	2.41	0.75	1.00	3.00	3.00	-0.82	2.24
LoC2 (k079)	7127	2.68	0.65	1.00	3.00	3.00	-1.80	4.72
LoC3 (k080)	7118	2.13	0.89	1.00	3.00	2.00	-0.26	1.32
LoC4 (k082)	7097	2.62	0.70	1.00	3.00	3.00	-1.55	3.79
LoC5 (k087)	7112	2.32	0.87	1.00	3.00	3.00	-0.67	1.64
LoC6 (k088)	7121	2.20	0.86	1.00	3.00	2.00	-0.40	1.45
LoC7 (k091)	7115	1.50	0.80	1.00	3.00	1.00	1.15	2.55
LoC8 (k092)	7097	2.40	0.77	1.00	3.00	3.00	-0.83	2.17
LoC9 (k094)	7129	2.84	0.47	1.00	3.00	3.00	-3.00	11.02
Measures of Cognitive Skill								
MATH (b10math)	7128	44.62	12.43	0.00	72.00	45.00	-0.45	3.35
READ (b10read)	7086	41.37	12.30	1.00	65.00	43.00	-0.42	2.43
BASWD (b10baswd)	7028	10.38	4.99	0.00	32.00	10.00	0.48	3.12
BASRD (b10basrd)	7018	22.55	4.24	1.00	34.00	22.00	0.05	3.04
BASS (b10bass)	7001	12.21	2.55	0.00	20.00	12.00	-0.29	3.66
BASM (b10basm)	7007	15.78	5.29	0.00	28.00	16.00	-0.24	2.47
SPELL (b10spell)	7122	35.37	10.45	0.00	50.00	37.00	-0.77	2.98
PCLT (b10plct)	7248	61.80	10.48	7.00	100.00	62.00	-0.05	3.37

Note: The table contains descriptive statistics for the (unbalanced) analysis sample.
Source: Own calculations based on data from the British Cohort Study 1970.

6.5.3 Handling panel attrition

Panel attrition is problematic when the probability of dropping out is not distributed randomly. If drop-out is systematically related to certain characteristics of the participants, panel attrition may undermine the sample's representativity and thus limit the generalizability of statistical inference.

The BCS70 suffers from severe panel attrition (i.e., the drop-out of participants of longitudinal studies over time). Out of the 17.195 individuals who participated in the first wave, only 9.116 (53%) still participate at 42. In their survey of panel attrition in the BCS70 up to 2012 (Mostafa and Wiggins, 2015) demonstrate that drop-out in the BCS70 is not random but associated with various characteristics that are observable at birth, including sex and parental social status. They find that males from lower social backgrounds whose parents were single at birth are particularly likely to drop out of the survey. These findings strengthen the case for the need to correct for panel attrition, given that the aim here is to make inferences about the influence of socio-economic background on outcome variables measured later in life.

To account for panel attrition in the BCS70, Inverse Probability Weights (IPW) were constructed as suggested in (Mostafa and Wiggins, 2015). IPW weight responses of survey-participants with the inverse of the individual's estimated probability of remaining in the survey based on a number of characteristics that determine panel drop-out. This means that the responses of individuals who have characteristics that render them very likely to drop-out but who remained in the survey receive higher weights. Inferences from weighted estimations will be unbiased for those characteristics used in the logistic regression estimating the probability of remaining in the survey (Mostafa and Wiggins, 2015).

The probability of having remained in the panel until age 42 is estimated by a logistic regression for each of the original survey participants. The model attempts to explain dropout by characteristics that are observable in the first year when the sample is still assumed to be representative. Sex social class at birth (based on father's occupation or mother's occupation if father's is not available), mother's and father's country of origin (as dummies), mother's age of completing education, mother's marital status at birth, mother's age at delivery and whether breastfeeding was attempted were included as predictors of drop-out. Moreover, birth weight was included as an omnibus measure for the health to capture drop-outs due to premature deaths. Birth-order (parity) was included as a control variable, as it has also been shown to predict drop-out (Mostafa and Wiggins, 2015). Table 6.2 shows the results of the logistic regression. Based on the regression results, the probability of being still in the survey at 42 is calculated for each individual. The inverse of this probability equals the weighting factor, which the individual receives later in the analysis.

In line with the results of Mostafa and Wiggins (2015) females were more likely to remain in the sample than men. The probability of remaining in the sample also increased with parental occupational status, mother's age at delivery, and birth-weight. A child of a non-manual worker was about 1.5 times more likely to still be in the sample at 42 than unskilled worker's offspring. Migration background, in contrast, reduced the probability of remaining in the sample, as did being born later in the parity and being born to a single mother. The predictive power of birth-characteristics in explaining dropout by 42 is relatively weak (pseudo R^2 of only 3.2%). This is little surprising, as many of the factors driving selection out of the panel may not be present or observable at birth. Constructing the weights at a later age when better predictors might be available would, however, be biased by the drop-out up to this point. The pseudo R^2 is comparable in size to that of Mostafa and Wiggins (2015) and even improves slightly upon their model for the 2012 wave, possibly because the model used here includes birth-weights and thus captures most of the premature deaths due to ill health.

Having constructed the weights by taking the inverse of the predicted probability to remain in the sample, the weights are applied to the sample that has remained in the survey until 2012. Table 6.3 shows the distribution of certain key characteristics in the original sample of 1970 and among those who remained in the sample until 2012 without and with weights. The results indicate that the weights correctly adjust for panel attrition with regards to the variables included in the construction of the weights. As the logistic regression upon which the weights are based includes sex, several indicators of socio-economic background, migration background, and single parenthood, the constructed weights should mitigate panel attrition regarding these aspects.

Table 6.2: Logistic regression results

	Odds Ratios	
	Response at 42	
Gender		
Female (reference: Male)	1.446***	(0.046)
Mother's age at delivery (reference: less than 20)		
20-24	1.193**	(0.072)
25-29	1.269***	(0.083)
30-34	1.281***	(0.095)
35-52	1.427***	(0.127)
Migration Background (reference: UK Background)		
Foreign background	0.558***	(0.037)
Mother's age at completion of education (reference: 14 or less)		
15	1.156*	(0.080)
16	1.237**	(0.095)
17	1.221*	(0.110)
18-31	1.116	(0.096)
education not finished	1.175	(0.460)
Mother's marital status (reference: married)		
separated divorced widowed	0.915	(0.112)
single	0.621***	(0.048)
Parental occupational class (reference: V unskilled)		
IV partly-skilled	1.258**	(0.093)
III manual	1.334***	(0.090)
III non manual	1.531***	(0.120)
II managerial and technical	1.578***	(0.126)
I professional	1.625***	(0.164)
single parent - nonworking and not classified	0.857	(0.195)
Parity (reference: 0)		
1	0.936	(0.038)
2	0.818***	(0.043)
3	0.696***	(0.049)
4	0.533***	(0.041)
Breastfeeding (reference: not attempted)		
attempted	1.364***	(0.048)
Birth weight (reference: less than 2000g)		
2001g - 3000g	2.429***	(0.276)
3001g - 4000g	2.619***	(0.291)
4001g - 5000g	2.765***	(0.341)
more than 5000g	2.066*	(0.689)
Pseudo R^2	0.032	
Observations	16,650	

Note: The table shows exponentiated coefficients for the logistic regression upon which the weights are based, p-values in parentheses;
Significance levels: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
Source: Own calculations based on the British Cohort Study 1970.

Table 6.3: Distribution of key characteristics (unweighted vs. weighted)

Characteristic	**1970** base sample	**2012** unweighted	**2012** weighted
Male	51.82	47.70	51.68
Mother of foreign origin	7.69	5.37	7.58
Single Mother	5.54	4.13	5.55
Mothers age at delivery: 25-29	30.92	32.30	30.89
Parents' status: Unskilled	6.57	6.57	6.45
Parents' status: Managerial and technical	13.07	14.70	13.19
Birth-weight: 3001g - 4000g	62.02	66.56	65.05

Note: The table shows the mean of key characteristics in the representative base sampel (1970) and the sample in 2012 with and without weights. The number of available observations varies by characteristic.

6.6 Results

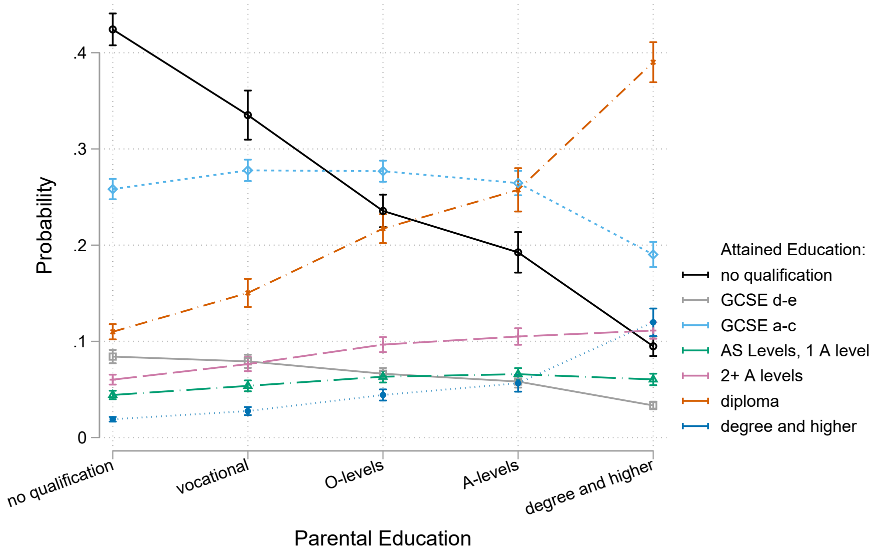
6.6.1 Descriptive statistics and bi-variate analyses

To what degree is children's status attainment associated with their socio-economic background? Figures 6.3 - 6.5 show bi-variate associations between parental and children's status indicators. In the present data, a person who has at least one parent with a degree level is roughly four times more likely to attain a degree level herself than someone whose parents obtained a vocational educational degree. If none of the parents has attained an educational qualification, the offspring are twice as likely to leave school without a certificate than offspring of parents where at least one parent has obtained A-Levels. Similarly, the chances of becoming a manager are about one-and-a-half times higher for someone who has at least one parent in a managerial position than for someone whose parents are skilled manual workers. The correlation between a personsâ hourly wages before taxes and transfers and their parents equivalenced weekly household income when they were 5 years old is 0.228 (Figure 6.5). As expected, there is a significant degree of association between parents' and children's social status, regardless of which indicator of status attainment is used.

Does locus of control play any significant role in this association? The bivariate correlations displayed in Table 6.4 indicate that SEB is positively associated with locus of control. Locus of control is positively associated with all three status measures. The same is true for cognitive skills. The correlations with cognitive skills are consistently larger than the respective correlations with locus of control.[29]

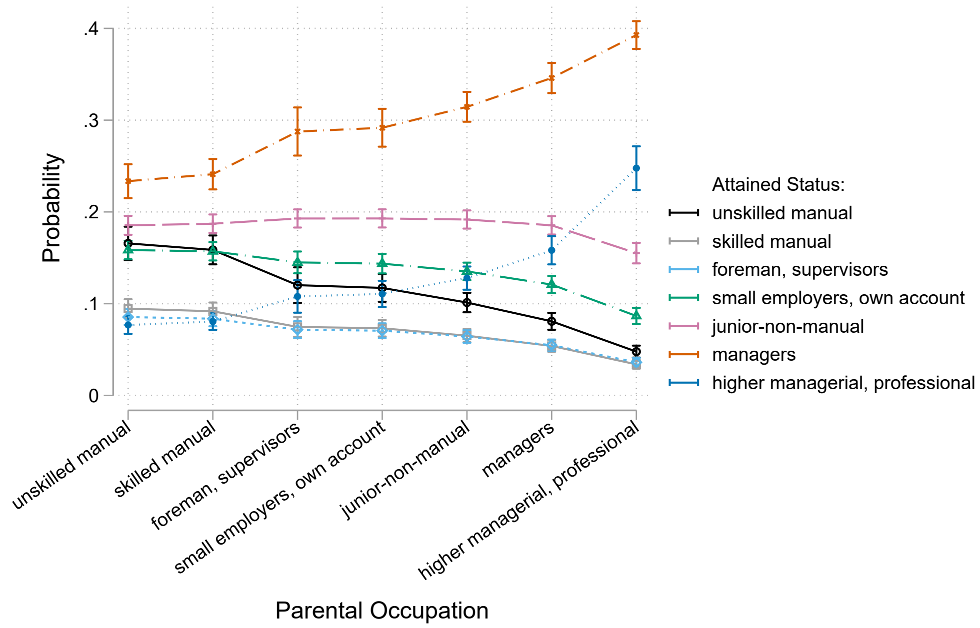
[29]The correlations in Table 6.4 are based on full information maximum likelihood estimations. This means that cases are not dropped when individual items are missing.

Figure 6.3: Predicted probabilities of attaining certain educational levels by highest level of parental education



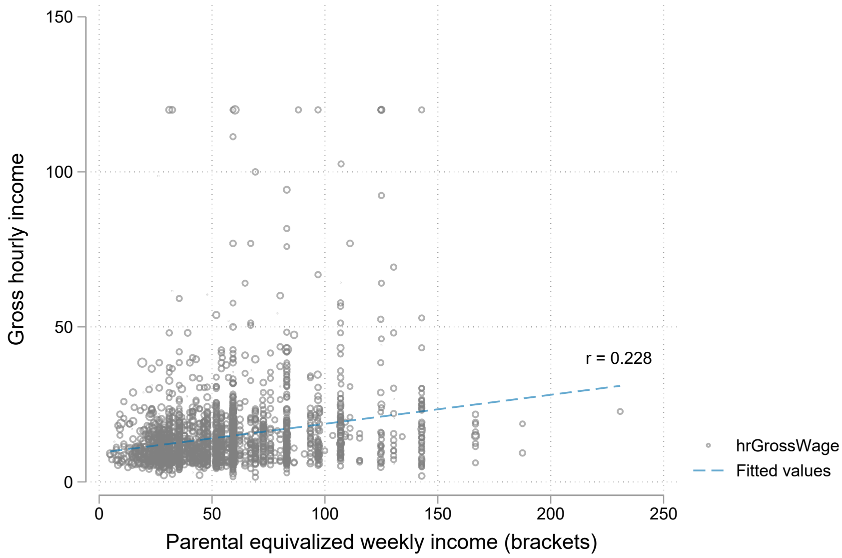
Note: The figure shows the predicted probabilities of attaining the respective levels of education by the age of 42 by highest parental education when the child was 10; Predicted probabilities were obtained from weighted ordered logistic regressions without control variables.
Source: Own calculations based on BCS70, weighted.

Figure 6.4: Predicted probabilities of attaining a certain occupational status by highest level of parental occupation



Note: The figure shows the predicted probabilities of attaining a particular occupational status by the age of 42 by highest parental occupational status when the child was 10; Predicted probabilities were obtained from weighted ordered logistic regressions without control variables.
Source: Own calculations based on BCS70, weighted.

Figure 6.5: Correlation between parental household income and hourly wages (gross)



Note: The figure shows the correlation between parental household income at the age of 5 and own hourly wages (gross) at the age of 42;
Source: Own calculations based on BCS70, weighted.

Table 6.4: Correlations between latent and dependent variables

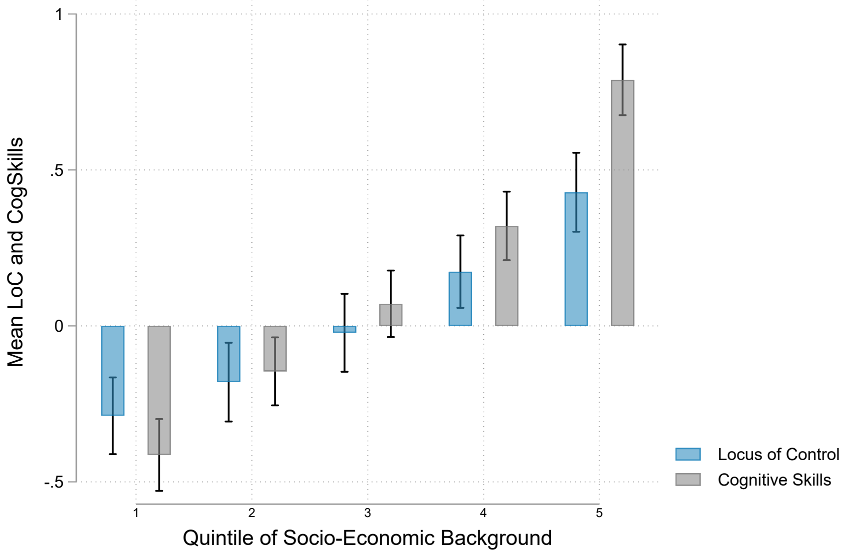
	LoC	CogSk	SEB	Wage	Occ	Edu
LoC	1,000					
CogSk	0.660	1,000				
SEB	0.387	0.527	1,000			
Wage	0.318	0.344	0.331	1,000		
Occ	0.299	0.369	0.326	0.428	1,000	
Edu	0.374	0.464	0.440	0.394	0.419	1.000
Sample	8903					

Note: Estimated correlation matrix (weighted) for latent and dependent variables;
Source: Own calculations based on full information maximum likelihood. All correlations are significant at the 1% level.

Figure 6.6 displays the mean of locus of control by quintile of socio-economic background and indicates a clear gradient in internal locus of control with respect to socio-economic background. The gradient is, however, somewhat less pronounced than the gradient found in cognitive skills.

Graphical representations of the associations between the intervening variables of locus

Figure 6.6: Locus of control and cognitive skills by socio-economic background



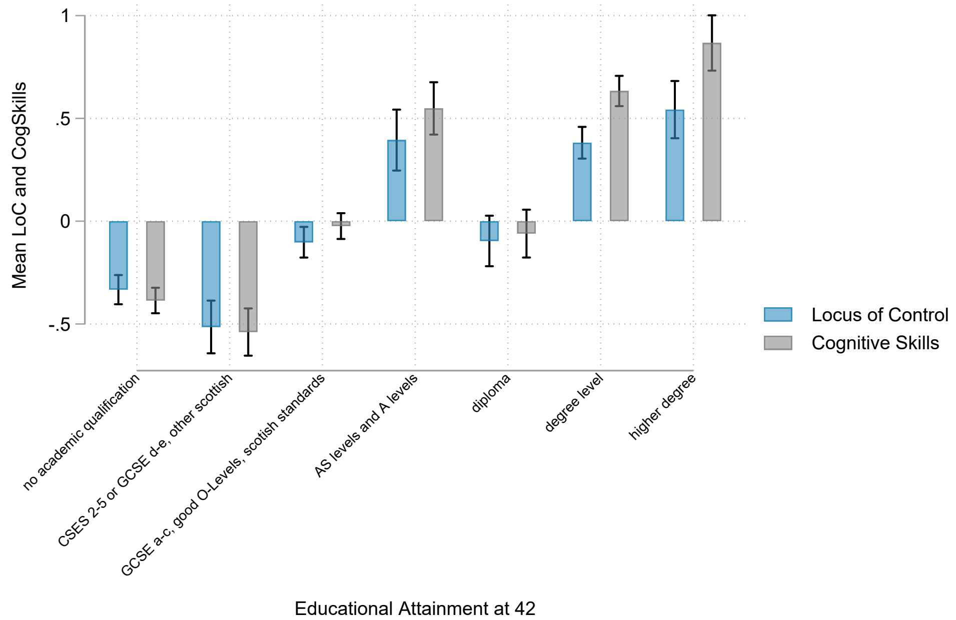
Note: The figure displays mean levels of locus of control and cognitive skills at age 10 by quintile of socio-economic background;
Source: Own calculations based on BCS70, weighted.

of control and cognitive skills and each of the outcome variables are provided in Figures 6.9 to 6.8. All three figures clearly show that higher levels of status attainment at 42 are associated with higher internality and cognitive ability at age 10. Jointly, these figures indicate that childhood locus of control, as well as cognitive abilities, mediate the influence of a person's socio-economic background on their own status.

For the moderation hypotheses, the descriptive analyses displayed in Figures 6.10 to 6.12 indicate that the interaction pattern between locus of control and socio-economic background differs by status variable.

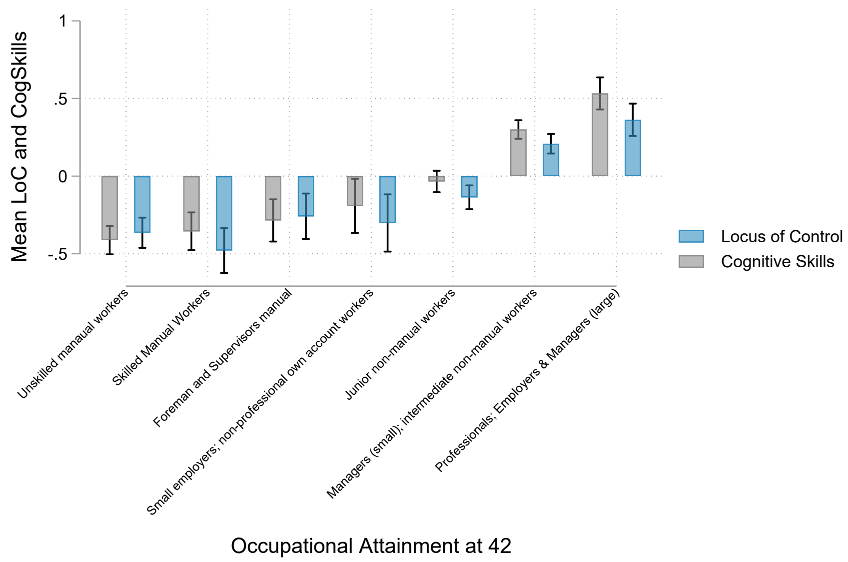
For educational attainment, the difference between individuals from high and low socio-economic background increases with locus of control. When internal locus of control is very low, socio-economic background does not seem to matter for educational attainment. As internal locus of control increases, the difference between individuals from high and low socio-economic backgrounds increases. This implies that individuals with more internal control orientations are more effective in translating their high SEB into status attainment. The descriptive analysis suggests that socio-economic background and locus of control complement each other in educational attainment. This leads to cumulative advantages in the 'Duncan and Blau sense' - i.e., status-group differences in the returns to

Figure 6.7: Educational status by locus of control and cognitive skills



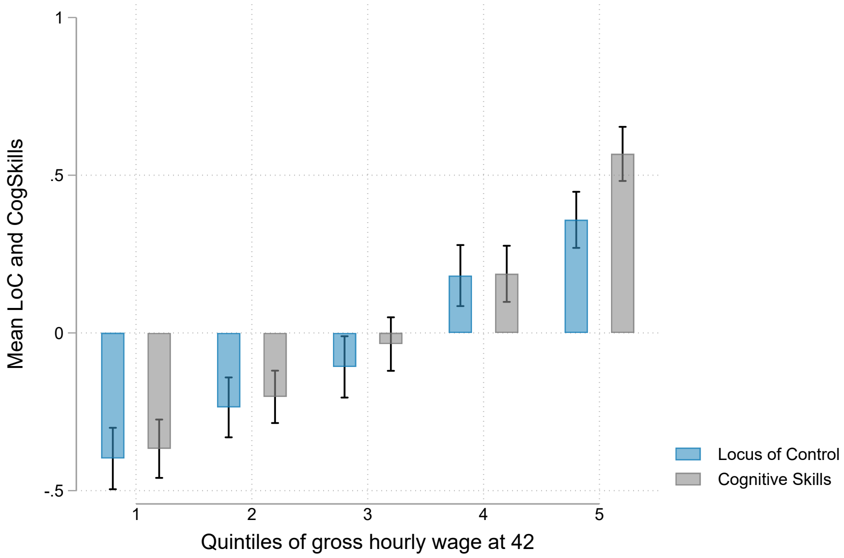
Note: The figure displays mean levels of locus of control and cognitive skills at age 10 by highest educational level by the age of 42;
Source: Own calculations based on BCS1970, weighted.

Figure 6.8: Occupational attainment by by locus of control and cognitive skills



Note: The figure displays mean levels of locus of control and cognitive skills at age 10 by occupational status at the age of 42;
Source: Own calculations based on BCS1970, weighted.

Figure 6.9: Hourly wages by locus of control and cognitive skills

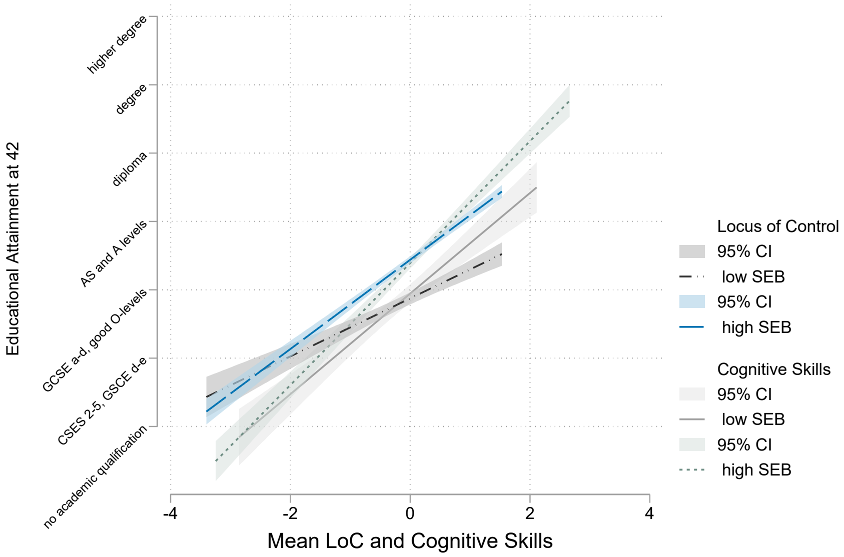


Note: The figure displays mean levels of locus of control and cognitive skills at age 10 by quintiles of hourly gross wages at 42 (weighted);
Source: Own calculations based on BCS1970, weighted.

a third variable. A similar pattern shows for cognitive abilities: when cognitive abilities are very low, educational attainment does not differ by socio-economic background. The higher the cognitive abilities the greater is the difference between individuals from high and low socio-economic backgrounds. Unsurprisingly, the association between cognitive abilities and educational attainment is stronger than the association between locus of control and educational attainment.

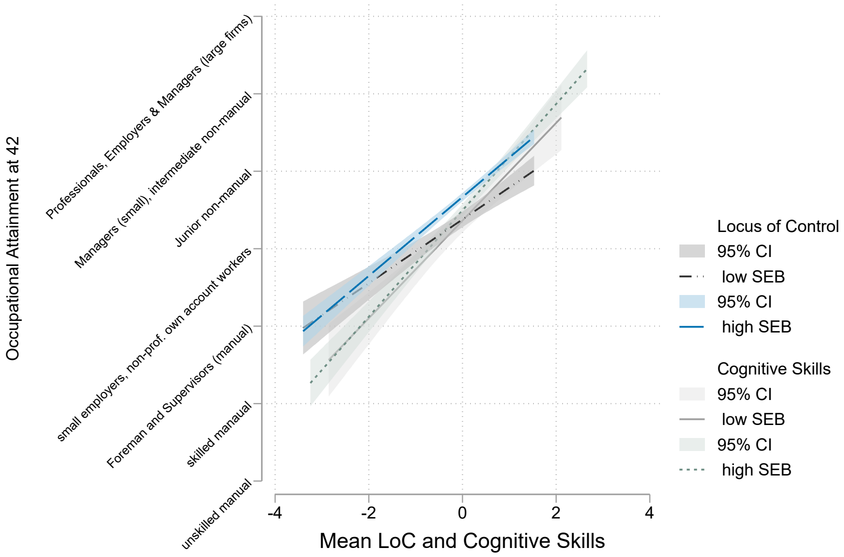
A similar pattern is observed for occupational attainment. At low levels of internality and cognitive skills, occupational attainment does not differ by socio-economic background. With increasing cognitive abilities and increasingly internal locus of control orientations, individuals from above-average socio-economic backgrounds gain an increasing advantage over individuals from lower socio-economic backgrounds. The pattern is less pronounced than for educational attainment, though. The association between locus of control and occupational attainment is weaker than the association between cognitive skills and occupational attainment. The advantage of high-SES individuals over low-SES individuals also increases with cognitive skills. The increase in the advantage is however less strong than for locus of control.

Figure 6.10: Educational attainment over SEB for high and low internal Locus of Control



Note: The figure shows mean educational attainment by 42 over the range of socio-economic backgrounds for high and low internal locus of control and high and low cognitive skills; Individuals with an internal locus of control / cognitive skills above the mean (0) are categorized as high, individuals with locus of control / cognitive skills below the mean are categorized as low.
Source: Own calculations based on BCS1970, weighted.

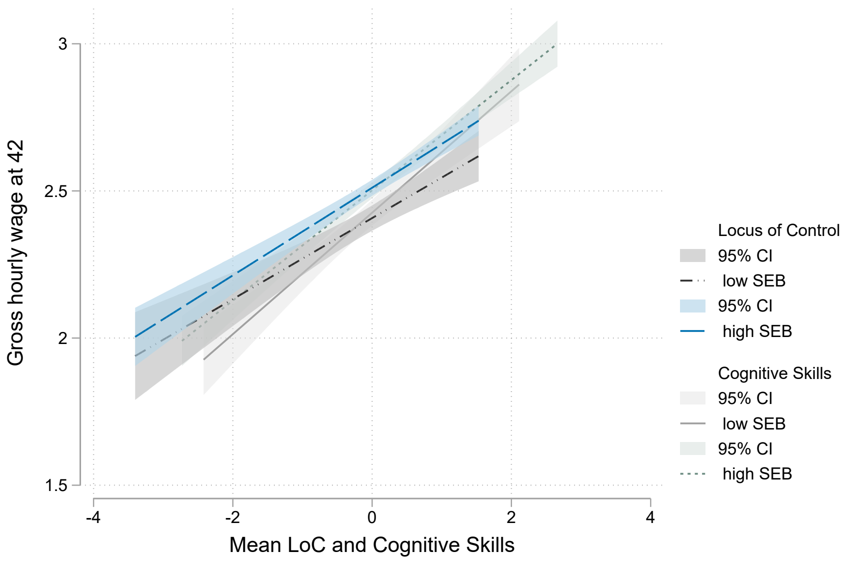
Figure 6.11: Occupational attainment over SEB for high and low internal Locus of Control



Note: The figure shows mean occupational attainment by 42 over the range of socio-economic backgrounds for high and low internal locus of control and high and low cognitive skills; Individuals with an internal locus of control / cognitive skills above the mean (0) are categorized as high, individuals with locus of control / cognitive skills below the mean are categorized as low
Source: Own calculations based on BCS1970, weighted

Wages also increase with internality. Individuals from high-SES households receive slightly higher wages than individuals from low-SES households, but this premium does not increase substantively as locus of control becomes more internal. For cognitive abilities, the advantage of individuals from high-SES households even decreases slightly, indicating a compensatory interaction effect. It seems that at very high levels of cognitive abilities, low socio-economic background implies a disadvantage.[30]

Figure 6.12: Gross hourly wage over SEB for high and low internal Locus of Control



Note: The figure shows mean gross hourly wages at 42 over the range of socio-economic backgrounds for high and low internal locus of control and high and low cognitive skills; Individuals with an internal locus of control / cognitive skills above the mean (0) are categorized as high, individuals with locus of control / cognitive skills below the mean are categorized as low
Source: Own calculations based on BCS1970, weighted

[30]Note: An alternative way of displaying the descriptive results is provided in Table A.2 in Appendix A. Therein mean status attainment is displayed for high and low internality and high and low cognitive skills across the range of socio-economic backgrounds. The results suggest a complementary relationship between locus of control and socio-economic background for educational attainment, independent effects for occupational attainment, and a compensatory relationship for gross hourly wages. The difference in the results may be because different groups are compared in these analyses. In the analyses above, individuals from high and low-SES backgrounds were compared, whereas, in the Appendix, the groups are based on high and low internal control orientations. Theoretically the moderation effect can follow only one pattern: either there is no moderation effect (independent effects), a positive moderation (complementation), or a negative moderation (compensation).

6.6.2 Multivariate Analyses

6.6.2.1 Measurement Model

Exploratory factor analysis was used to test whether the items load on a single factor. If this was the case, Cronbach's alpha was used to assess the reliability of the scale. If Cronbach's alpha was sufficiently high[31] and the principal factor explained a substantial part of the variation in the indicator variables, the measurement model was adopted into the SEM. The final measurement model was tested using robust Diagonally Weighted Least Squares (DWLS), which is particularly apt for ordinal indicator variables that are skewed (Brown, 2015; Muthén, 1984), as it is the case for the indicators of locus of control.

Standardized estimates for the measurement model are presented in the first column of Table 6.5. Fit indices and factor loadings indicate a good model fit: Root Mean Squared Error of Approximation (RMSEA) was between 0.031 and 0.034. Comparatory Fit Index (CFI) and Tucker-Lewis Index (TLI) indicated that the measurement model constitutes a 96% improvement over the baseline model which assumes no relationship among indicator variables (Maslowsky et al., 2015). All of the items loaded significantly on the respective constructs with factor loadings being consistently larger than 0.4.

The pattern of factor loadings for the indicators of socio-economic background obtained in the measurement model was consistent with theoretical expectations. Paternal education was weighted highest, followed by maternal education, paternal occupational status and equivalized family income. Maternal occupational status received the smallest weight. At several points in the remainder of the section reference will be made to high and low SEB. Because the definition of high as 1 SD above the mean, and low as 1 SD below the mean are not very intuitive, two examples for each group are given in Table 6.6 below.

The loadings on the indicators for locus of control show that most weight is given to items which are related to schooling. Hence the locus of control indicator should not be considered a general indicator of locus of control but rather as related to schooling. This should be taken into account when interpreting the results of the further analyses. For cognitive skills, most weight is given to the reading test, followed by the math test.

[31] That is, if the conventional threshold of $alpha > 0.75$ was met.

Table 6.5: Measurement Component of the SEM Model

	Measurement		**Mediation**		**LoC Moderation**		**Full model**	
Method	WLSMV		WLSMV		UPI (MLR)		UPI (MLR)	
Goodness of Fit Statistics								
OBS	8674		8767		8767		8767	
df	206		114		119		142	
RMSEA	0.033		0.03		0.033		0.031	
95% CI (RMSEA)	0.031 - 0.034		0.029 - 0.031		0.032 - 0.034		0.030 - 0.031	
TLI	0.956		0.950		0.890		0.883	
CFI	0.961		0.957		0.902		0.895	
Measurement Component								
	b	se	b	se	b	se	b	se
Socio-Economic Background								
Parental Income	0.601	0.011	0.601	0.011	0.572	0.010	0.568	0.011
Mothers Education	0.805	0.010	0.806	0.009	0.696	0.009	0.703	0.010
Vathers Education	0.818	0.009	0.819	0.009	0.769	0.008	0.764	0.009
Mothers Occ Status	0.599	0.014	0.599	0.014	0.542	0.012	0.540	0.013
Vathers Occ Status	0.732	0.010	0.730	0.010	0.722	0.009	0.721	0.009
Locus of Control								
LoC1	0.521	0.014	0.520	0.014	0.445	0.013	0.445	0.013
LoC2	0.672	0.014	0.671	0.014	0.512	0.014	0.507	0.014
LoC3	0.620	0.013	0.616	0.013	0.538	0.013	0.539	0.013
LoC4	0.597	0.015	0.602	0.015	0.462	0.014	0.462	0.013
LoC5	0.428	0.016	0.430	0.016	0.303	0.014	0.303	0.014
LoC6	0.577	0.013	0.574	0.013	0.495	0.013	0.495	0.013
LoC7	0.593	0.016	0.594	0.016	0.417	0.013	0.424	0.013
LoC8	0.665	0.012	0.668	0.012	0.561	0.012	0.562	0.012
LoC9	0.407	0.022	0.411	0.022	0.278	0.016	0.276	0.016
Cognitive Ability								
MATH	0.821	0.006	0.823	0.006	0.821	0.006	0.821	0.006
READ	0.852	0.005	0.858	0.005	0.867	0.004	0.867	0.004
BASWD	0.778	0.006	0.782	0.006	0.758	0.006	0.758	0.006
BASRD	0.446	0.011	0.446	0.011	0.454	0.011	0.454	0.011
BASS	0.727	0.007	0.725	0.007	0.715	0.008	0.716	0.008
BASM	0.639	0.009	0.642	0.009	0.662	0.008	0.661	0.008
SPELL	0.627	0.009	0.637	0.009	0.653	0.009	0.654	0.009
PLCT	0.727	0.007	0.727	0.007	0.718	0.008	0.718	0.008
Social Background*Locus of Control								
Fathers' Edu*LoC2					0.420	0.017	0.410	0.016
Mother's Edu*LoC8					0.408	0.016	0.415	0.016
Father's Occ*LoC3					0.380	0.015	0.383	0.015
Mother's Occ*LoC4					0.244	0.012	0.244	0.012
Family Income*LoC7					0.232	0.011	0.237	0.011
Social Background*Cognitive Skill								
Fathers' Edu*READ							0.711	0.012
Mother's Edu*MATH							0.577	0.015
Father's Occ*BASWD							0.562	0.012
Mother's Occ*PLCT							0.402	0.014
Family Income*BASS							0.399	0.014

Note: Measurement component of the Structural Equation Model using weights. The first column in each model represent standardized coefficient estimates, while the second column contains the standard errors. All coefficients in this table have a significance level of $p < 0.001$.

Table 6.6: Examples for high and low socio-economic backgrounds

	High socio-economic background (1 SD above the mean)				
Example	Mother's Education	Father's Education	Mother's Occ Status	Father's Occ Status	Household (per capita, per week)
a)	A-Levels	A-Levels	Unskilled Manual	Professional	60
b)	O-Levels	O-Levels	Junior Non-manual	Junior Non-manual	94
	Low socio-economic background (1 SD below the mean)				
Example	Mother's Education	Father's Education	Mother's Occ Status	Father's Occ Status	Household (per capita, per week)
a)	No Certificate	No Certificate	Skilled manual	Unskilled manual	51
b)	No Certificate	O-Levels	Unskilled manual	Skilled manual	23

Note: The table provides two examples for high (1 SD above the mean) and low (1 SD below the mean) socio-economic background respectively. Examples are cases from the data-set that are very close to the respective thresholds of one SD above the mean and one SD below the mean.

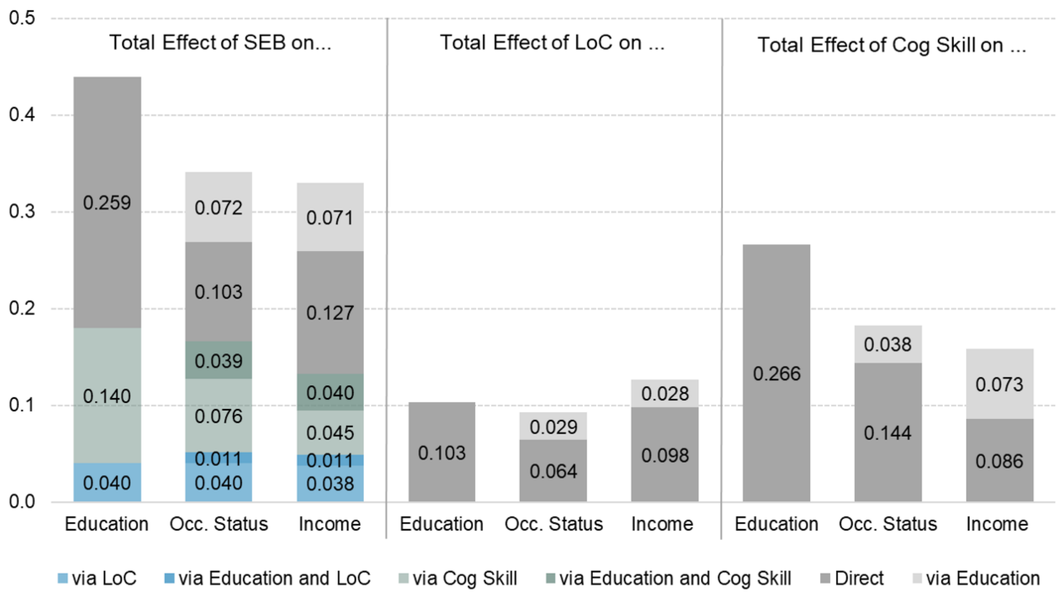
6.6.2.2 Mediation Analysis

Whether locus of control and cognitive skills mediate the influence of socio-economic background on own status attainment is tested within a structural equation model using a DWLS estimator. This estimation technique was chosen as it has been designed to allow ordinal indicator variables and does not make any assumptions about the distributional shape of the indicator variables (Muthén, 1984). Several simulation studies indicate that DWLS estimation provides the most robust results for non-normally distributed ordinal indicator variables (Bandalos, 2014; DiStefano and Morgan, 2014; Finney Sara J. and Christine DiStefeano, 2013; Li, 2016). The measurement component of the mediation model can be found in the second column of Table 6.5. Structural model results are presented in the first column of Table 6.7. All coefficient estimates are standardized, to allow for better comparison between coefficients. Fit indices indicate a good model fit. RMSEA improves slightly, as compared to the measurement model, while TLI and CFI decrease but remain above the conventional threshold of 0.95.

The results for the mediation model (first column in Table 6.7) indicate the association between parental socio-economic status and internal (academic) locus of control, and cognitive abilities measured at the age of 10 is statistically significant and positive. The association between socio-economic background and cognitive skills is slightly larger (1.36 times) than the association between socio-economic background and locus of control. At the same time, all of the status outcomes - i.e., highest educational attainment by 42 as well as the occupational classification and gross hourly wages at 42 - are positively associated with the person's socio-economic background, and her internal academic control orientation and cognitive abilities in a statistically significant way. Jointly these findings indicate that the positive association between socio-economic background and education, wage, and occupational status is mediated through locus of control and cognitive skills. Sobel tests confirm that locus of control mediates the influence of socio-economic background on education (test statistic: 4.972, se: 0.049; p-value: 0.000), occupational status (test statistic: 3.001, se: SE 0.046; p-value: 0.002) and gross hourly wages (test statistic: 2.832; se: 0.023; p-value: 0.005). Sobel tests for cognitive skills are also all significant at the 5% level. Hence, parts of the total effect of a person's socio-economic background are transmitted via locus of control and cognitive skills.

To identify the share of total effect of SEB that is mediated through locus of control and cognitive abilities, the total effect of SEB was decomposed into its direct and specific indirect components (Muthén and Asparouhov, 2014). The results are displayed in Figure 6.13.[32] .

Figure 6.13: Decomposition of total effects into direct and indirect effects



Note: The figure shows the decomposition of the total effects of socio-economic background (left panel), locus of control (middle panel), and cognitive skills (right panel) on educational attainment, occupational attainment and gross hourly wages (logged) respectively; Standardized coefficients obtained from weighted estimates of the mediation model (2nd column of Table 6.7) are shown;
Source: Own illustration based on Table A.2 in Appendix A

[32]The data underlying the Figure are provided in Tables A.2 in Appendix A

The total effect of SEB on education is slightly larger than its total effect on occupational status and income. For all three status attainment indicators, the larger part of the influence of SEB is direct. Locus of control mediates less than a tenth of the total effect of SEB on education. Cognitive skills mediate roughly a third of the total effect of SEB on educational attainment. For occupational attainment and gross hourly wages, locus of control mediates 15% of the total effect of SEB respectively (compared to one third and one quarter for cognitive skills). Education mediates roughly a fifth of the total effect of SEB on occupational attainment and gross-income. Locus of control and cognitive skills affect occupational status and wages mostly direct (see the two right-hand-side sections of Figure 6.13). Only a small fraction of the mediators' influence is mediated via education .

The evidence thus suggests that the size of the mediation effect transmitting parental status on children's status attainment via locus of control is between one third and one half of the mediation effect running via cognitive skills, and at least half as big as the mediation through education.

For the covariates the mediation analysis results are in line with previous research. Male participants tended to have a higher internal locus of control at the age of 10 and earn more at 42. There were no gender differences for cognitive skills but females, on average, obtained higher educational degrees. No gender differences were found with regard to occupational status. Being born into a single-parent household and having a migration background was weakly negatively associated with locus of control. The negative association between migration background and cognitive abilities is plausible, considering that the measure of cognitive skills includes several language-related tests. Nevertheless, having a migration background is positively associated with all status outcomes.

6.6.2.3 Moderation Analyses

Results for the moderation analyses are reported in the second and third column of Table 6.7. The second column reports results for a model that includes only the interaction between locus of control and socio-economic background (LoC Moderation). Column three contains results for the full model in which cognitive skills were also allowed to moderate the effect of parental status on children's status outcomes (Full Model).[33]

[33] Table A.5 in Appendix A contain the same analyses including only gender as an additional conrol variable. The results of remain qualitatively and quantitatively the same.

Model fit decreased slightly after introducing the interaction terms. TLI and CFI fall below the conventional threshold of 0.95. RMSEA remains below 0.05 in both interaction models. This reduction in model fit is at least partly due to using the product indicator method for constructing the interaction terms. As the RMSEA is satisfying and TLI and CFI remain above 0.88, the moderation models are still considered to have satisfactory model fit. Results for the first moderation model which includes only the interaction between locus of control and socio-economic background are depicted in Figure 6.14.

In both moderation models, SEB has a positive and statistically significant effect on locus of control, cognitive abilities and all three indicators of status attainment. Locus of control continues to mediate the association between SEB and education, occupational attainment and wages at 42. The same ist true for cognitive skills. However, the significance of the direct association between cognitive abilities and gross hourly wages drops to the 10% level upon introducing the interaction between cognitive abilities and socio-economic background. *The previous section's conclusion remains vaild*: Locus of control and cognitive abilities mediate the influence of parental socio-economic status on own status attainment and the mediation via locus of control is about one-third to one-half of the size of the mediation through cognitive abilities.

With regards to the moderation hypotheses, the evidence is more ambiguous. The majority of the tested interaction effects are not significant, with one exception: SEB moderates the effect of locus of control on education, as long as socio-economic background and cognitive skills are assumed to have independent effects on education. The positive interaction terms implies that the beneficial association between a more internal (less external) control orientation and educational attainment increases with parental SES. SEB and locus of control complement each other in educational attainment. Figure6.15 illustrates how the educational return to locus of control differs by SEB.[34]

[34] In essence, Figure 6.15 shows the coefficient of locus of control on educational attainment conditional on SEB. This *conditional indirect effect* is calculated as follows:

$$CIE_{LoC} = \hat{\gamma_1}(\hat{\beta_{1k}} + \hat{\beta_{3k}}\, SEB_i) \tag{6.6}$$

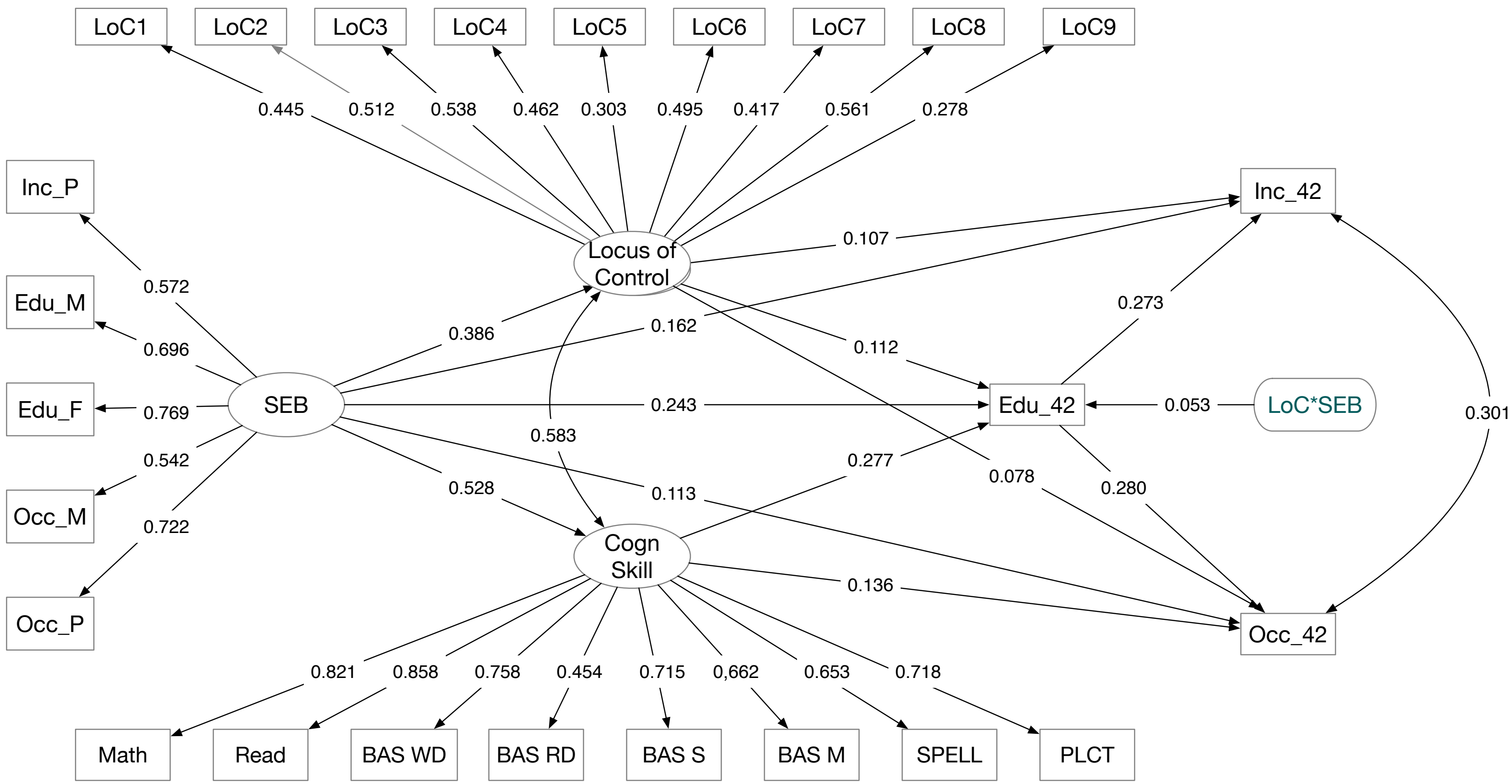
The conditional indirect effect of locus of control is at the same time the total natural indirect effect (TNIE) of SEB (Muthén and Asparouhov, 2014).

Table 6.7: Structural Component of the SEM Model

	Mediation		**LoC Moderation**		**Full model**	
Method	WLSMV		UPI (MLR)		UPI (MLR)	
Goodness of Fit Statistics						
Observations	8767		8767		8767	
estimated parameters	114		119		142	
RMSEA	0.03		0.033		0.031	
95% CI (RMSEA)	0.029 - 0.031		0.032 - 0.034		0.030 - 0.031	
TLI	0.950		0.890		0.883	
CFI	0.957		0.902		0.895	
Structural Component						
Locus of Control						
SEB	0.387***	0.015	0.386***	0.015	0.386***	0.015
gender (male)	0.043**	0.015	0.029*	0.014	0.029*	0.014
migr. backgr	-0.056**	0.018	-0.046*	0.018	-0.044*	0.018
single mother	-0.063***	0.017	-0.034*	0.016	-0.033*	0.016
Cognitive ability						
SEB	0.527***	0.011	0.528***	0.011	0.529***	0.011
gender	0.017	0.013	0.008	0.012	0.009	0.011
migr. backgr	-0.093***	0.015	-0.081***	0.015	-0.073***	0.015
single mother	-0.046**	0.015	-0.005	0.013	-0.001	0.012
Education						
SEB	0.259***	0.014	0.243***	0.017	0.240***	0.017
Cognitive Skill	0.266***	0.018	0.277***	0.019	0.289***	0.022
Locus of Control	0.103***	0.020	0.112***	0.022	0.102***	0.025
SEB*LoC			0.053*	0.022	0.027	0.034
SEB*Cogn					0.038	0.027
gender (male)	-0.061***	0.010	-0.059***	0.010	-0.057***	0.010
migr. backgr	0.083***	0.012	0.091***	0.013	0.090***	0.013
single mother	-0.041**	0.012	-0.021	0.011	-0.021	0.011
hourly Wages (logged)						
SEB	0.127***	0.027	0.162***	0.029	0.162***	0.028
Cognitive Skill	0.086*	0.033	0.064^{+}	0.033	0.067^{+}	0.039
Locus of Control	0.098**	0.034	0.107**	0.037	0.105*	0.041
SEB*LOC			-0.007	0.038	-0.011	0.055
SEB*Cogn					0.004	0.047
Education	0.273***	0.015	0.273***	0.023	0.272***	0.023
gender (male)	0.329***	0.017	0.313***	0.016	0.313***	0.016
migr. backgr	0.080***	0.020	0.071**	0.022	0.070**	0.022
single mother	-0.027	0.025	-0.017	0.018	-0.017	0.018
Occ Status						
SEB	0.103***	0.017	0.113***	0.018	0.121***	0.018
Cognitive Skill	0.144***	0.020	0.136***	0.022	0.121***	0.023
Locus of Control	0.064**	0.021	0.078**	0.023	0.089***	0.025
SEB*LOC			-0.014	0.023	0.017	0.036
SEB*Cogn					-0.047	0.029
Education	0.279***	0.013	0.280***	0.013	0.281***	0.013
gender (male)	-0.001	0.011	0.003	0.011	0.003	0.011
migr. backgr	0.071***	0.015	0.071***	0.012	0.071***	0.012
single mother	-0.008	0.014	-0.003	0.013	-0.003	0.013
Intercepts						
Education	1.192***	0.025	1.180***	0.014	1.179***	0.014
Wages	3.840***	0.071	3.921***	0.081	3.921***	0.081
Occ Status	2.125***	0.032	2.074***	0.033	2.070***	0.033
Correlations						
LoC with Cog Skills	0.578***	0.013	0.583***	0.014	0.583***	0.014
Wage with Occ Status	0.288	0.014	0.301***	0.017	0.302***	0.017
R2						
houlry Wages	0.324***	0.015	0.325***	0.022	0.326***	0.016
Occ Status	0.227***	0.010	0.238***	0.010	0.230***	0.010
Education	0.286***	0.011	0.291***	0.011	0.293***	0.010
Locus of Control	0.159***	0.012	0.153***	0.012	0.153***	0.011
Cognitive Skill	0.289***	0.012	0.285***	0.013	0.285***	0.012

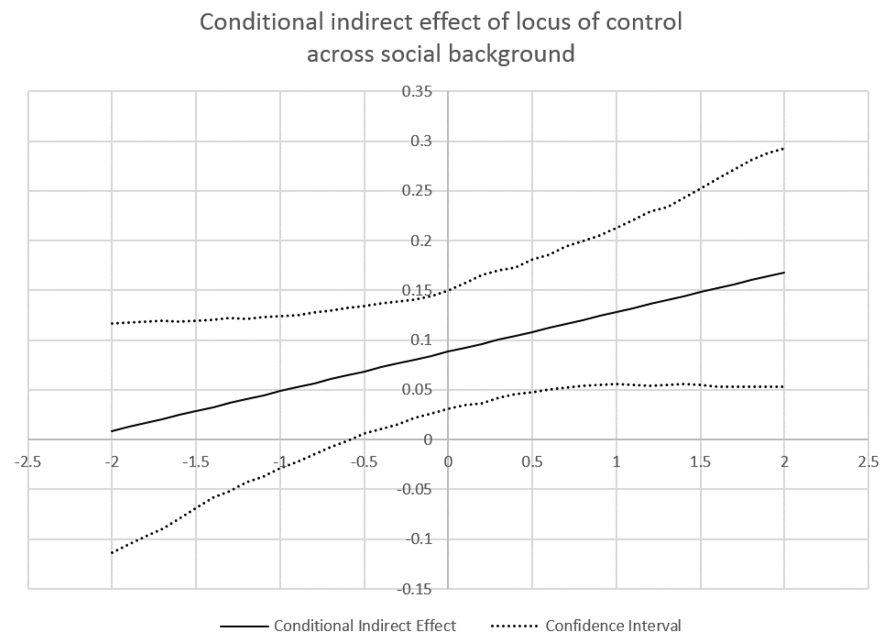
Note: The table shows the standardized weighted results for the moderation model. The first column in each model represent standardized coefficient estimates, while the second column contains the standard errors. Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{+}$ $p < 0.10$

Figure 6.14: Full Structural Equation Model



Note: The figure illustrates standardized weighted results for the LoC Moderation model based on the second column of Table 6.7).
Only paths significant at the 95% level or higher are depicted. Paths for gender, migration background and single-parent household are not shown.

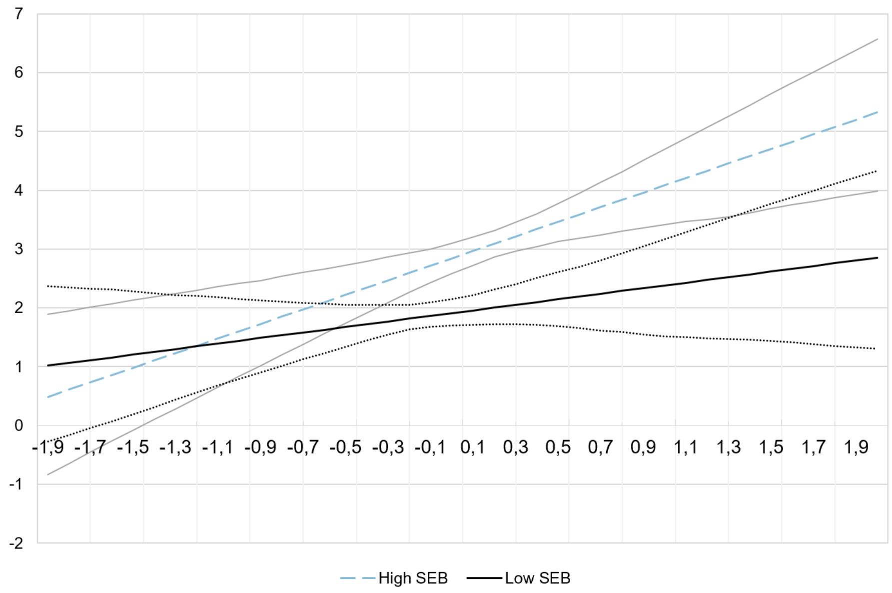
Figure 6.15: Conditional Indirect Effect of Locus of Control (LoC Moderation)



Note: The graph shows the conditional indirect effect of a 1 standard deviation increase in locus of control on education across social backgrounds. Confidence intervals where obtained via bootstrapping using 500 replications and 400 observations. Model population was based on the results for the moderation model in column 2 of Table 6.7.

What does this increase in the conditional indirect effect of locus of control on educational attainment mean in the British educational system? Figure6.16 plots the estimated total indirect effect of locus of control for two exemplary groups: a high SEB group, whose socio-economic background is 1 SD above the mean, and a low SEB group with a socio-economic background of 1 SD below the mean. Having a strongly internal locus of control orientation (1 SD above the mean) as opposed to a low internal locus of control orientation (1 SD below the mean) is associated with an increase of 2.5 points on the education scale, which equals 2-3 degrees for high SEB individuals. For individuals with a low socio-economic background, the same difference in internal control orientation is associated with an increase of 0.9 points or roughly one educational degree. This difference is rather substantive, considering the importance of educational attainment in career opportunities. In line with the fertile soil hypothesis, high-SES parents seem to provide resources that are crucial to benefit from internal control beliefs in the realm of education. Once cognitive abilities are also allowed to moderate the effect of social background (Full Model) this effect ceases to be statistically significant.

Figure 6.16: Total effect of locus of control at different levels of socio-economic background (LoC Moderation)



Note: The graph shows predicted values for education at different levels of locus of control for individuals from a high vs low socio-economic background. Y-Axis: Educational Attainment; X-Axis: Locus of control. Confidence intervals where obtained via boostrapping using 500 replications and 400 observations. Model Population was based on the results for the LoC Moderation model (column 2) in Table 6.7.

For occupational attainment and gross hourly wages, neither the interaction term for locus of control nor the interaction term for cognitive ability is significant in either of the two models. Thus, the evidence suggests that socio-economic background and locus of control have independent effects on occupational attainment and wages, holding education constant. The same is true for cognitive abilities.

Interpreting these results, it is useful to recall that only the five indicators from the locus of control scale with the highest factor loadings were used to construct the interaction term. Since these five indicators all were school-related, the interaction term is even more focused on the academic sphere than the latent construct of locus of control used in the mediation analysis. Therefore, it is less surprising that the interaction term only had a significant effect on educational attainment, but not on occupation or wages. Children's beliefs about their causal influence on academic outcomes moderated the influence on educational attainment, but not on occupational attainment or hourly gross wages.

6.6.2.4 Sensitivity Analyses

To test whether the obtained results are due to variable specifications, sensitivity analyses with alternative variable specifications were conducted. Detailed results for the Full Model using different variable specifications can be found in Table A.6 in Appendix A.

When the highest level of education attained at age 42 is replaced with National Qualification Levels obtained from academic qualifications, qualitatively and quantitatively very similar results are obtained, with two minor differences. Firstly the negative effect of growing up with a single mother on educational attainment turns significant. Secondly, cognitive ability has a statistically significant positive effect on hourly wages. In both cases the coefficients of the original estimation in Table 6.7 were close to significance.

Two alternative classifications for occupational status were tested: In Model 2, the National Statistics Socio-Economic Classification (NS-SEC) was used to measure occupational status. In Model 3, the Social Class Indicator (SC based on variable BD9SCS) was used. Results for both models were similar to those in the main estimation. The interaction term between cognitive skills and SEB was negative and significant for the alternative definition using the NS-SEC. In the main model, the same coefficient barely failed significance (t-statistic: 1.62). In the alternative definition using the Social Class Indicator, the interaction between SEB and cognitive skills is also negative and significant at the 10% level. The negative interaction term indicates that the positive effect of cognitive skills for occupational status is larger at lower levels of parental SES. Holding education constant, individuals from disadvantaged backgrounds can compensate their low SEB with higher cognitive skills. Individuals from advantaged families can compensate for lower levels of cognitive skills with their advantageous SEB. Hence, both alternative definitions of occupational status yield evidence in favor of a substitution effect of cognitive skills. The difference in the significance is likely to be due to the slight differences in the content of these definitions. While the social class indicator prioritizes required skill levels, the other two definitions focus on contractual differences, the type of labor (manual vs. non-manual), and the degree of self-direction at work (Rose et al., 2005). Moreover, the Social Class Indicator only has six categories, whereas the other two indicators have seven categories. The larger amount of cases per category may lead to a more precise estimation, thus increasing the precision of the estimation.

6.7 Discussion

This study tested whether and to what extent locus of control mediates the influence of parental socio-economic status on own status attainment using longitudinal data from the BCS70. Additionally, joint effects of parental social status and locus of control on status attainment were investigated. Two competing hypotheses for such joint effects were deducted from existing literature: The fertile soil hypothesis and the resource substitution hypothesis. The fertile soil hypothesis predicts children from more privileged households to benefit more from internal locus of control because their internality falls on fertile soil of other resources that allow a more efficient capitalization of their locus of control. Resource substitution assumes that resources can substitute each other. On the one hand, this means that high-SES individuals can use the various other resources at their hands to compensate for low internality. On the other hand, individuals from low-SES households can use internality to compensate for the disadvantages associated with their low social origin. If the fertile soil hypothesis found support, this would imply cumulative advantages for high-SES children, and cumulative disadvantages for low-SES children. If resource substitution co-occurs with a mediation process by which individuals from lower socio-economic backgrounds are less likely to obtain those locus of control orientations that would otherwise compensate for their low SEB, social closure were reinforced.

The findings indicate that locus of control mediates the influence of social background on education, hourly gross wages, and occupational status. To provide a more intuitive grasp on the practical relevance of this mediation effect, the mediation effect of locus of control was compared to that of cognitive skills. For all three status attainment variables, a large part of the influence of SEB on the status outcome is direct (education: 62%; occupational status: 31%; wages: 39%). Cognitive skills were found to mediate a larger part of the influence of SEB on status attainment than locus of control. Locus of control mediates roughly a tenth of the total effect of SEB on education (compared to almost 30% for cognitive skills). For occupational attainment and gross hourly wages, locus of control mediates 15% of the total effect of SEB respectively (compared to one third and one quarter for cognitive skills). Education mediates a little more than 20% of the total effect of SEB on occupational status and gross hourly wages. Hence, locus of control is just a little less important than education in the transmission of social status from one generation to the next. Considering that locus of control is only one out of many potentially relevant socio-emotional skills, it is very impressive that its effect in the intergenerational transmission of occupational status is one-third to half the size of cognitive skills, and almost as large as that of education.

With regards to the moderation hypotheses, the findings indicate that the association between locus of control and status attainment does not differ by social class - at least when cognitive skills are also allowed to moderate the influence social background on attained status.[35] Once obtained locus of control benefits individuals from all social classes equally. This means that *existing differences between social groups are not exacerbated further through higher rates of return to locus of control for already privileged individuals.* It also means that *existing social class differences cannot be overcompensated through raising the locus of control of children from socio-economically deprived households.* The effects of locus of control and SEB on children's status attainment are independent. There may, of course, be other compensatory effects, which have not been tested here.

What remains is that locus of control is one relevant channel through which the influence of parental social status on their children's status attainment is mediated. Children from less privileged social backgrounds thus face a dual disadvantage: Firstly, their low socio-economic background has a direct negative effect on attained status. Secondly they are less likely to develop strongly internal control convictions in childhood, which have been shown to be positively associated with desirable status outcomes.

6.7.1 Fit with prior research

To what extent are these findings congruent with prior research? The results are very similar to those of the closely related study by Blanden et al. (2007). Considering that they used an entire battery of socio-emotional skills, it is relatively surprising that their estimate is only 4% higher. Their estimate of the importance of cognitive skills is only 2% higher than the one attained in this study. The similarity of results is also remarkable because their estimates are based on a slightly different method.

[35] There is evidence that cognitive abilities may be able to compensate for low socio-economic background with regards to hourly wages. For educational attainment and occupational status, no evidence of a compensatory effect was found.

In the present study, about two-thirds of the total effect of locus of control on occupational status is direct, and only one third is mediated via educational attainment. This is in contrast to results obtained by von Stumm et al. (2009) who do not find a significant direct effect of locus of control on social class measured at 30, apart from the indirect effect through education. Because their study is based on the same data, a closer look at the differences in findings is warranted. The sensitivity analysis indicates that this difference in findings is not due to differences in social class definition. One reason for the nill finding by von Stumm et al. (2009) might be that they measure status attainment at the age of thirty, when the status attainment process may not be fully finished. Yet, associations between locus of control and status outcomes have been identified at even younger ages in the same data set: Flouri (2006) associated locus of control as measured at 10 with educational attainment at 26, and Breen (2001) showed more internal locus of control measured at 10 to reduce the log-odds of having a skilled or non-skilled manual job as opposed to a job in the upper service class by the age of 26. The difference in results might also be explained through the difference in the formation of the latent indicator for locus of control. von Stumm et al. (2009) dropped all indicators with a loading below 0.2, resulting in 11 indicator variables. In the present study, all indicator items with loadings below 0.4 were dropped, such that nine indicators remained. This may have led to a slight difference in the meaning and the precision of measurement of the locus of control variable.[36]

Ng-Knight and Schoon (2017a) did not find locus of control in youth to be associated with a variety of different measures of SEB using data from the Longitudinal Study of Young People in England (LYPSE). Several methodological differences may explain this difference in findings: Their measure of locus of control was more general than the education-centered one used in this study. Locus of control and SEB were measured later in adolescence. Measuring parental status at the age of 13 may be too late to find a significant correlation with locus of control at 14. Locus of control may be formed earlier in life. This one-year lagged locus of control measurement may not provide sufficient time for

[36] Additional analyses (not reported here) show that the difference in findings regarding the direct effects of locus of control on occupational outcomes can also not be explained fully through the introduction of an additional channel of mediation via behavioral problems, which von Stumm et al. (2009) find to be a significant predictor of occupational status and education. A similar indicator for behavioral problems as rated by the mother at the age of 10 was introduced into the mediation model. Locus of control remained a significant mediator of the influence of socio-economic background on all three status outcomes after introducing behavioral problems as an additional mediator. The results regarding behavioral problems are in line with those of von Stumm et al. (2009). Behavioral problems are another significant mediator of social background on educational attainment at 42, but not on wages or occupational status at 42.

locus of control to ‘update’ to the present socio-economic circumstances. Another reason for the nill-finding might be, that at the age of 14 locus of control might be less dependent on parental status than at the age of ten because experience outside the family increasingly shape control beliefs. Hsin and Xie (2017) found, however, that the dependence of locus of control on parental income and maternal education increases between Kindergarten and 8th grade.[37] Another potentially relevant difference is that the children in the study by Ng-Knight and Schoon (2017a) were born 20 years later than the children observed in this study. These children may have been more subject to a general societal narrative of self-responsibility for outcomes (Shane and Heckhausen, 2017).

Despite some inconsistencies, empirical investigations of the 1970 British cohort study by and large indicate that locus of control is on the one hand associated with parental background and that it significantly affects diverse status outcomes including, education, occupational class, and income (Blanden et al., 2007; Breen, 2001; Flouri, 2006; Lenton, 2014; von Stumm et al., 2009). Regarding the mediation hypothesis the findings are thus in line with existing research within the same or a similar institutional setting.

Evidence regarding the *moderation hypotheses* is more sparse. Most comparable is a study by Ng-Knight and Schoon (2017a) on the ability of locus of control to compensate for unfavorable economic conditions in childhood in the transition to employment. Their results indicate that locus of control moderates the adverse effects of less favorable SEB on time spent NEET, up to a certain degree. Also, in support of a compensatory effect Aspelmeier et al. (2012) found that the relationship between locus of control and self-esteem and academic attainment was strongest for first-generation students. Hence locus of control was more important for those who had fewer other resources. Investigations of moderator effects of other socio-emotional traits, such as the Big Five, found that higher levels of at least some of the Big Five could compensate for low-SEB in the educational and occupational attainment process (Damian et al., 2015; Shanahan et al., 2014). However, the moderating effect ceased to be significant when cognitive skills were held constant and allowed to moderate the effect of SEB on status attainment (Damian et al., 2015). This latter finding has been replicated for locus of control in this study.

[37] Their income measure is an average of parental incomes between kindergarden and 5th grade. Averaging over several years makes their measure less prone to measurement error.

The mediating role of *cognitive skills* in the intergenerational transmission of social status is more established (Deary et al., 2005; Griliches and Mason, 1972; Hauser et al., 1983; Jencks, 1979). For moderation the evidence seems to support a resource substitution effect (Johnson et al., 2006). Damian et al. (2015) find that higher cognitive skills may compensate for the adverse effects of a low socio-economic background on income. Simultaneously, the positive effects of higher cognitive abilities on educational and occupational outcomes are found to be even stronger in high-SES families.

The results regarding the *relative importance* of cognitive skills and locus of control in status attainment are in line with several studies which indicate cognitive abilities to be more important partial predictors of later achievement than socio-emotional abilities (Deary et al., 2005; Duncan et al., 2007; Hsin and Xie, 2017; Lleras, 2008).

6.7.2 Limitations and selected requirements for further research

One major limitation of the study is that no claims to causality can be made. All identified effects are *statistical* effects only. Identifying causal effects would require exogenous variation in locus of control, which does not affect any other beliefs, values, or traits, affecting the outcomes in question. Identifying causal effects of single socio-emotional skills is such an intricate task because these skills are closely related and difficult to distinguish. This speaks in favor of investigating the effects of broader groups of socio-emotional abilities together.

Another limitation is that the present study considers the moderating and mediating roles of locus of control and cognitive skills only in a static framework. It does not capture differences in the developmental trajectories of cognitive and socio-emotional skills. As prior research indicates that the developmental trajectories of cognitive skills and socio-emotional skills differ across the life-course (Hsin and Xie, 2017; Prevoo and ter Weel, 2015). Future research should consider moderating and mediating roles of both types of skills in a dynamic framework.

The instrument to measure locus of control in this study had a strong focus on the academic self-concept. Hence, the results cannot be extended to a more general concept of locus of control. A replication with a more general measure of locus of control would be desirable. Moreover, the measure of locus of control focused on the internal dimension of locus of control. If internal and external locus of control are two distinct dimensions, their relationship with SEB and status attainment might differ. To gain a comprehensive understanding of the role of locus of control in the intergenerational transmission of social status, the mediating and moderating role of external locus of control should also be considered. Ideally, complex relations between internal and external locus of control and SEB should be considered in a single framework to determine their relative importance.

Another limitation concerns the generalizability of the study results to the current generation of children. However, this downside was willingly accepted to receive a more accurate estimate of the effect of locus of control on status attainment. While this limitation is hard to avoid without losing methodological rigor, it is important to consider factors that may affect the generalizability of the results to younger generations. Recent research has provided evidence that the level of internality has increased over the last decades and that it increases with the economic development of a country (Park and Lau, 2016; Shane and Heckhausen, 2017). At the same time, the more recent studies on children growing up in the 1990s and early 2000s indicate that parental social status remains a major determinant of childhood locus of control (Park and Lau, 2016; Tudge et al., 2000). It is difficult to predict whether locus of control will still be an important determinant of status when children who are born now arrive at the peak of their careers. Considering the well-documented effects of locus of control on other psychological indicators, including well-being and affective disorders, it seems however, warranted to say that greater internality is beneficial irrespective of its effects on social status.

6.8 Conclusion

A synopsis of the locus of control research from different disciplines suggests that locus of control may play a significant role in the transmission of social status from one generation to the next. This Chapter has provided the first empirical test of this hypothesis. Locus of control was found to partly mediate the association between a person's socio-economic background and their own status attainment. The share of the association mediated by locus of control is roughly one-third to one-half of the share that is mediated via cognitive skills. It is also almost as important as education in mediating parental SES on income and occupational status. Locus of control thus plays a relevant role in the transmission of social status from one generation to the next. Children from low-SES households are less likely to be endowed with high levels of internality and cognitive skills, both of which are beneficial for educational and occupational attainment later in life. The lack of resources that underlies low status and the resulting socialization experiences erode low-SES children's opportunities to obtain those skills which would increase their chances of obtaining high levels of education, and well paid, highly estimated employment. Further analyses revealed that locus of control and socio-economic background affect educational attainment, occupational class and income independently. This implies that the beneficial effects of locus of control and cognitive abilities are identical across the social distribution.

Fostering cognitive abilities has long been established as a means to enhance low-SES children's life chances. Socio-emotional skills arrived at the agenda of policymakers more recently (OECD, 2015). The evidence found here suggests that locus of control is a central variable in the status attainment process, roughly one-third to half as important as cognitive skills. Hence, if policymakers and educators are looking for socio-emotional skills to target in intervention and educational programs, they may be well advised to look at locus of control. Locus of control is such an interesting candidate, because it is such a high-level socio-emotional skill. As pointed out in Chapter 5, locus of control affects the choice of goals and efforts by modulating the expected return to efforts. Successful improvement of locus of control beliefs (a discussion of what this means exactly will be provided in Chapter 9) may entail a plethora of beneficial effects, including improved physical and psychological health, more adaptive coping strategies (Brosschot et al., 1994), and enhanced motivation (Spence, 1983). Fostering low-SES children's locus of control thus seems desirable at the individual, as well as the societal level.

Evidence on the malleability of locus of control is still scarce. There is some evidence from intervention studies (see Section 8.3) but more basic questions, such as the degree to which locus of control is genetically and socially determined, are still unresolved. More research on both questions is required to develop effective and cost-efficient intervention or education programs. In line with these research needs, the next two chapters will be concerned with genetic and extra-familial influences on locus of control.

Chapter 7

Genetic and environmental determination of locus of control

"Any dispassionate reading of the evidence leads to the inescapable conclusion that genetic factors play a substantial role in the origins of individual differences with respect to all psychological traits"

(Rutter, 2008, p.2).

7.1 Motivation, research aim and contribution

The previous chapter established that 10% to 15% of the intergenerational persistence in social status can be attributed to locus of control. Reducing the social gradient in locus of control may provide a chance to enhance fair equality of opportunity. The total potential for a reduction in intergenerational status persistence *through locus of control* is likely to be smaller than the share of intergenerational status persistence that is due to locus of control. This is because the potential for a reduction in intergenerational status persistence through locus of control is chiefly determined by the degree to which locus of control is genetically and socially determined. The *research aim* of this chapter is therefore to identify the degree to which locus of control is genetically determined and to which environmental factors shape it.

Reliable information on the genetic and social determination of locus of control is essential when the importance of locus of control for fair equality of opportunity is considered: Genetic determination might partly explain social class differences in locus of control. If a similar set of genes determined locus of control and status outcomes, genetic confounding might drive the associations between parental status, locus of control, and children's status outcomes. Thus, genetic determination of locus of control may provide a natural *upper bound for the effectiveness of intervention programs* targeting locus of control. Awareness of such boundaries is essential for the development of cost-efficient and effective programs.[1]

In addition to these intervention-related concerns, the genetic determination of locus of control also is *relevant for compensatory claims*: Some normative accounts of distributive justice regard inequalities that result from factors, for which the individual cannot be held responsible, including genetic endowment, as unjust, warranting justice claims of the unjustly disadvantaged (Anderson, 1999; Cohen, 1989; Dworkin, 1981).[2] To the extent that inheritance explains inequality in locus of control, this inequity, and any differences in access to advantage that result from it, would be regarded as unjust. Reliable information on the heritability[3] of locus of control is essential to assess the grounds for such normative claims.

So far, there is only a handful of behavior-genetic studies on locus of control (see Section 7.4). These studies' results vary significantly by measure of locus of control, the dimensions, the age of the population under study, and the type of informant. Independently of the inequality focus adopted in this thesis, further evidence on genetic and environmental determinants of locus of control is needed to provide a consistent picture of the heritability of locus of control and its dimensions.

The empirical analyses in this chapter contribute to the behavior-genetic literature on locus of control by analyzing evidence from a novel data-set, the TwinLife study. The TwinLife study is a representative multi-cohort study of German same sex twins and their extended families. The extended family design of the study allowed a joint estimation of

[1] The normative desirability of such efforts and potential positive and negative aspects and consequences are not discussed here. Whether such paternalistic compensatory initiatives are warranted, necessary, or legitimate must be decided by the respective societies. This research merely aims to provide the empirical evidence on the grounds of which such debates can be fruitfully led.

[2] The correctness of the normative argument is not discussed here. Empirical evidence on the acceptance of this principle among laypeople is mixed. Although most studies find that responsibility plays a pivotal role in fairness assessments (Cappelen et al., 2013; Schokkaert and Truyts, 2017; Tinghög et al., 2017), some studies also show that inequality resulting from factors for which the individuals could not be made responsible was not always compensated (Mollerstrom et al., 2015; Weinzierl, 2017).

[3] Heritability (h2) is the degree of population variation in a trait that can be explained by genetic differences. Its complement (1-h2) captures the degree of population variation in a trait that is due to environmental factors and measurement error Bouchard (2004).

dominant and additive genetic effects as well as twin-specific environmental effects and vertical cultural (i.e., non-genetic) transmission from parents to children. The present study is the first to report extended twin design evidence for locus of control.

A better understanding of the degree to which locus of control is genetically and socially determined, by factors that are shared by twins, or factors that are specific for each twin, is an important guidepost for further sociological research into the more fine-grained social mechanisms that may affect locus of control formation.

7.2 Theoretical and methodological foundations in behavior-genetic research

This section provides relevant background information on the genetic determination of trait-like characteristics in general. It is assumed that basic behavior-genetic principles that apply to other complex traits also apply to locus of control. The chapter also serves to establish the relevance of integrating behavior-genetic evidence and methods into sociological research designs.

7.2.1 The contributions of nature and nurture to complex traits

The extent to which trait-like characteristics are genetically determined or socially acquired has for a long time been subject of the *'nature-nurture debate'*. The antagonistic version of the nature *versus* nature debate has long been set aside as "overly simplistic and scientifically obsolete" (Shonkoff and Phillips, 2000, p.388). "Among knowledgeable researchers, discussions regarding genetic influences on psychological traits are not about whether there is genetic influence, but rather about how much influence there is, and how genes work to shape the mind" (Bouchard, 2004, p. 148).[4]

[4] Trait-like characteristics, such as locus of control, are assumed to be determined by large numbers of genes which varying but small effect sizes rather than a single gene or a few genes. Such systems of genes that jointly co-determine a complex phenotype are also called Quantatitative Trait Loci (QTL) (Plomin and Crabbe, 2000). The term 'quantitative trait loci' reflects the assumption that when a large number of genes distributed across the DNA jointly determine a complex trait, these traits are likely to be quantitative, spreading along a continuum rather than qualitative. QTL contribute interchangeably, additively, and non-additively to the genesis of a certain phenotype, "analogous to probabilistic risk factors" (Plomin and Crabbe, 2000, p. 808).

The existing empirical evidence cogently demonstrates that genetic *and* environmental factors[5] *co-determine* trait-like characteristics and their development. This 'joint determination' may take different forms. (Kendler and Eaves (1986) and Ottman (1996) offer a comprehensive and systematic overview over these potential forms.) Firstly, genetic and environmental risk factors might produce a phenotype[6] additively *(additive effects)*. In this case, exposure to environmental risk factors does not differ by genotype and the likelihood of a phenotype, given the exposure to a certain environment, does not depend on genetic setup (Kendler and Eaves, 1986). Secondly, genetic and environmental risk factors may interact in the production of a phenotype. This type of joint determination is referred to as *'gene-environment interaction'*.[7] Gene-environment interactions provide an integrative framework for the nature versus nurture debate and are currently the predominant behavior-genetic paradigm. Gene-environment interactions may take two forms: Either sensitivity to environmental factors varies with genotype *(genetic control of sensitivity to environmental factors)*, or the expression of genetic risk factors depends on (i.e., is moderated by) the environment *(environmental control of genetic effects)* (Purcell, 2002).[8] Taking a more sociological perspective Shanahan et al. (2008) distinguished four types of gene-environment interactions: Contextual triggering, where social context leads to the expression of a certain genetic risk factor, social context as compensation; social context as social control of genetic expression; and social context as enhancement. Thirdly, genetic setup might drive selection into certain environments *(genetic control of the exposure to environments)*. The latter case is often referred to as *'gene-environment correlation'* (r_{ge}) because instances of a genotype are more frequently found in certain environments (Kendler and Eaves, 1986).

[5] Environmental factors may be broadly defined and include, for example, exposure to physical, chemical or biological risk factors (e.g., temperature, exposure to pollutants and other harmful substances viruses), behavior patterns (e.g., late age at first pregnancy), life events (e.g., job losses, injuries, birth of children), or more general social-environmental factors, such as the social status of the family or the developmental status of the country (Ottman, 1996).

[6] The *phenotype* is the observable, measured trait.

[7] Although gene-environment *interaction* is the most common label for this new paradigm, it is somewhat misleading as it includes not only strictly interactive effects but also additive and selective effects. Some researchers prefer the term *'gene-environment transactions'* to reflect this multitude of potential relations.

[8] One prominent example for such gene-environment interactions is the investigation of the importance of genome and early childhood maltreatment for aggressive behavior, by Caspi et al. (2002), who found that both childhood maltreatment, as well as a certain genome structure, were jointly necessary for aggressive behavior, while each of the causes taken singly had no effect.

7.2.2 Why behavior-genetic research is relevant to sociology

These gene-environment interaction mechanisms should be of particular interest to sociologists interested in identifying the effects of particular social contexts on individuals. To date, the majority of sociological research uses genetically uninformed research designs that provide no opportunities to correct for genetic confounding (Perrin and Lee, 2007). Sociological research would benefit from utilizing the possibilities of genetically informed designs to get a better grasp of the environmental characteristics that influence human behavior. “People differ in how they interpret and react to their settings, and such differences likely reflect genetic factors. When these genetic differences are taken into account, a more nuanced view of the specific aspects of context that matter becomes possible” (Shanahan et al., 2008, p. 261). For sociologists to participate in this debate, they need to be acquainted with behavior-genetic terminology, the underlying theory, and the most commonly used methods.

Moreover, sociologists should actively engage in the research on gene-environment interactions because they are best equipped to provide a refined, theory-based framework for environmental influences on human behavior (Perrin and Lee, 2007). A sociologically informed conceptualization of the environment would consider that the environment is a complex of multiple, interactive, nested spheres, each defined by particular relations, roles, and influences and placed at a particular point in time (Bronfenbrenner, 1995; Jr. Elder, 1998). “Unfortunately, sociology (...) remains mostly silent or, worse, cedes the intellectual ground to genetics’ under-socialized conception of human behavior” (Perrin and Lee, 2007, p. 305).

7.2.3 Methods for quantifying genetic effects on complex traits

In general, there are two approaches to quantifying genetic influence on complex traits: quantitative genetics and molecular genetics. So far, sociological research has mostly relied on quantitative genetics. This is mainly due to the fact that the traits and behaviors studied by sociologists are highly complex and likely to be co-determined by hundreds or thousands of genes (Munafò and Flint, 2011). The amount of variation in such complex traits that can currently be explained by molecular genetics is still very low at the single-digit percentage point level (Plomin et al., 2016; Polderman et al., 2015).

Quantitative genetics builds on Mendelian inheritance rules and comprises a bundle of methods that exploit variation in the shared amounts of genes as determined by kinship relation and variation in the degree of shared environmental influence to decompose the variance in an observed phenotype into the relative contributions of genetic factors (A, for additive genetic effects), shared environmental factors (C for shared or common environment), and non-shared environmental factors and measurement error (E) (Hill, 2010).[9] The methods most frequently used are intergenerational correlations, sibling correlations, twin- and adoption studies. Twin and adoption studies have some advantages over the correlational designs. While family correlations can only unveil so-called '*familial effects*', which include joint variation due to shared genetic and shared environmental factors, twin and adoption studies can distinguish familial and genetic effects and even differentiate genetic effects further into additive and non-additive genetic effects.[10] The advantage of all these methods is that they do not require genetic material.

Molecular genetics, in contrast, utilize genetic material to identify the genetic sequences that cause the observed phenotype by connecting differences in the genetic code (DNA) to individual phenotype differences (Plomin and Crabbe, 2000; Rutter, 2002). Popular methods in molecular genetics are candidate gene studies, linkage analysis, and genome-wide association studies (all described in Appendix B).

7.2.4 Empirical evidence on genetic and environmental determination of complex traits

Before moving to locus of control, some basic findings of behavior-genetic research on trait-like characteristics are reviewed. Existing evidence on other traits may facilitate formulating hypotheses for locus of control. Moreover, it provides a useful reference frame for evaluating the results of the present analyses.

Evidence from intergenerational and sibling-correlation studies: Studies using intergenerational and sibling-correlation designs typically found correlations between fam-

[9] The development of the original statistical methods is credited to (Fisher, 1919) and (Wright, 1921).

[10] Additive genetic effects are linear combinations of individual genetic effects, while non-additive genetic effects also allow for some form of non-linear combinations of different genetic effects, including dominance or epistatic effects (Bratko et al., 2017; Plomin, 2003).

ily members' personality traits to be statistically significant and of moderate size, ranging from 0.1 to 0.6 with an average of 0.2, with sibling correlations typically being slightly higher than intergenerational correlations (Anger, 2012; Anger and Heineck, 2010; Bratko et al., 2017; Groves, 2005; Vukasović and Bratko, 2015). The size of the correlation in intergenerational studies typically increases with the age of the children (Anger, 2012; Vukasović and Bratko, 2015). Several reviews and meta-analysis of twin studies conducted over the last 50 years (mostly in industrialized western countries), consistently estimated the *overall heritability* of complex traits, including personality, to range around 0.5 (Bouchard, 2004; Bratko et al., 2017; Polderman et al., 2015; Turkheimer et al., 2005; Vukasović and Bratko, 2015). This means that half of the observed variation in personality and other complex traits is attributable to genetic factors. There is also great agreement that there are no gender differences in genetic influence on complex traits and very little gender differences in the heritability of complex traits (Bouchard, 2004; Polderman et al., 2015).

Evidence from twin and adoption studies: Intra-class correlations in complex traits have consistently been shown to be higher for monozygotic twins than for dizygotic twins, irrespective of whether they were raised apart or together (Bratko et al., 2017). This indicates that *genetic factors* have a significant influence on complex traits. The fact that intra-class correlation for identical twins was more than twice as large as the intra-class correlation of fraternal twins indicates that non-additive genetic effects affect character-traits (Bratko et al., 2017).

In a majority of the reviewed twin studies there was little evidence that *shared environmental factors*, such growing up in the same family, have a significant effect on trait-like characteristics (Bouchard, 2004; Bratko et al., 2017; Polderman et al., 2015; Vukasović and Bratko, 2015). The environmental influences that affect trait like characteristics were primarily non-shared. Adoption studies, in contrast, showed moderate but significant effects of shared environmental factors on a variety of complex traits (Buchanan et al., 2009). Studies on twins reared together may overestimate genetic, and under-estimate shared-environmental effects, because all family level influences are modeled to be equal for both twins, such that genetic and environmental components cannot be differentiated on the within pair level (Turkheimer et al., 2005). Hence, the adoption studies may provide a better estimate of shared-environmental effects than twin-studies of twins reared together.[11] "Such results are important reminders of the importance of validating conclusions from twin studies with results from other types of genetically informative studies" (Waaktaar and Torgersen, 2013, p. 658).

Despite the consistent finding that *non-shared environmental factors* are important determinants of personality, it has been very difficult to identify such factors (Neiderhiser et al., 2007; Turkheimer and Waldron, 2000). The Non-shared Environment in Adolescent Environment (NEAD) study was specifically designed to investigate the influence of differences in the environment within the family and family relations in particular. However, differential family relations did not have significant effects on personality (Neiderhiser et al., 2007). Bratko et al. (2017) introduced the term '*missing environmentality*' to point out that the specific environmental factors that contribute to the influence of non-shared environmental factors are largely unknown. Non-shared environmental influences have remained under the scientific radar for a long time and still provide opportunities for researchers to come up with interesting designs that might shed light on this topic.

The empirical evidence on genetic effects on character-like traits thus indicates that character traits are no different from other characteristics, such as height for example, with regards to genetic determination. The '*universal laws of behavioral genetics*' formulated by Turkheimer (2000, p. 160) also seem to apply to trait-like characteristics. These universal laws of behavioral genetics are:

1. "All human behavioral traits are heritable."
2. "The effect of being raised in the same family is smaller than the effect of genes."
3. "A substantial portion of the variation in complex human behavioral traits is not accounted for by the effects of genes or families."

[11] Adoption studies may still underestimate the influence of shared environmental effects due to the small amount of variance in the environment in these studies, that is due to the selective sample of (high SES) adoptive parents (Stoolmiller, 1999).

7.3 Theory and Hypotheses

Building upon the theory and literature reviewed above, more specific hypotheses regarding the genetic and environmental determination of locus of control are formulated.

It is assumed that locus of control is no different from other complex traits, and that the universal laws of behavior genetics (Turkheimer, 2000) apply to locus of control. This means that locus of control is expected to be heritable, and that heritability is due to additive, as well as dominant effects (A > 0; D > 0). The impact of genetic factors on locus of control is assumed to be larger than the influence of shared environmental factors i.e. (A + D > C). Non-shared environmental factors are expected to have a significant influence on locus of control (E > 0).

`H1:` $A > 0; D > 0; A+D > C; E > 0$

Is there anything specific about locus of control that may help to make these hypotheses more precise? Locus of control is a generalized expectation, based on a person's history experiences of contingency (Rotter, 1966). Locus of control could thus be said to be *learned*. Environmental factors are likely to determine the nature of these experiences. As a learned trait, locus of control may be hypothesized to be more dependent on the environment, than other traits, that are not 'learned' - or at least not to the same degree.[12] The evidence on the comparatively high malleability of locus of control over time and across the life-span further strengthens the expectation of a substantial environmental influence on locus of control. The nature of the concept and its low stability suggest that environmental influences might be particularly strong for locus of control.

Across the life-course the influence of environmental and genetic factors on expressed phenotype may change. A potential reasons for such changes might be gene-environment correlation (i.e., the selection into environments that are more aligned with one's genotype). The reflections in the Theory Chapter (Chapter 5) and evidence reviewed in the third Chapter suggest that social-environmental effects affect locus of control and that

[12]This distinction is certainly difficult to make, because to some degree, all traits will be learned or result from a history of experiences. Extroversion, for example, may also be learned in the sense that positive experiences with outgoing behavior may reinforce such behavior. Additionally social desirability will affect to what degree the expression of a certain trait is socially reinforced or punished.

locus of control is constantly updated, based on the history of prior experiences of contingency. Therefore, one may expect that the importance of genetic factors decreases across the life-span while that of environmental factors increases. This expectation is also in line with prior research that has found that genetic influence on personality decreases with age, while environmental factors become more important over the life-span (Briley and Tucker-Drob, 2017).

H2: *Genetic factors are expected to become less important in the determination of locus of control across the life-span; Environmental factors are expected to become more important over the life-span.*

7.4 Evidence on genetic and environmental influences on locus of control

This Section provides an overview of existing evidence of quantitative genetic designs on the heritability of locus of control.

7.4.1 Intergenerational associations

Studies on intergenerational associations of control perceptions indicate fairly low correlations between generations. Moreover, the size of the correlation varies depending on the age of the parents and their children.

For children aged 8 and 16 Nowicki et al. (2018b) found correlations with parental locus of control (measured at different time points from pregnancy until the child is aged 18-20) to range between 0.14 and 0.20. Using SOEP data Anger (2012) found significant correlations of 0.12 for internal locus of control between children aged 16 to 18 and their parents. Correlations for externality where slightly higher at 0.20 (Anger, 2012). Her study also found significant gender differences. For fathers and sons, the correlation for internal locus of control was slightly lower (0.09) while that for external locus of control was slightly higher (0.22) (Anger, 2012). For adult children, slightly larger correlations were found: Children's internality correlated with parents' internality with 0.21 (Anger, 2012). External locus of control showed a correlation of 0.27. For fathers and sons, the respective correlations are 0.19 for internal locus of control and 0.28 for external locus of control.

Ranging between 0.1 and 0.3, the reported intergenerational correlations for locus of control are comparable in size to intergenerational correlations of other complex traits, like the Big Five (Anger, 2012). The low association between generations may indicate that locus of control is formed by multiple sources, which include genes and the parental household, but are not restricted to it.

7.4.2 Evidence from twin studies

Heritability estimates from twin studies are typically slightly larger than those obtained from intergenerational- and sibling correlations. Only a handful of twin- and adoption studies investigated genetic determination of locus of control or one of its related constructs. An overview of these studies in provided in Table 7.1. These studies yielded divergent results depending on the measurement instrument, the dimension used and the informant.

For Rotter's original locus of control scale, Mosing et al. (2012) found a heritability of 0.3 using information from the Swedish Twin registry. Another Swedish study that also included Twins reared apart also found a heritability of about 30%, but only for internal control beliefs (Pedersen et al., 1989).[13] Beliefs about luck were mostly explained by environmental factors in this study (Pedersen et al., 1989). Based on a large sample of U.S. twins Bullers and Prescott (2001) found that genetic factors explained 15.5% of the variation in powerlessness while shared environmental factors explained another 15.5% of the variation. Non-shared environment and measurement error accounted for almost 70% of the variation in the powerlessness sub-scale.[14] A twin study with elderly participants that focused on health locus of control found no evidence of familiality for the internal sub-scale (Johansson et al., 2001).[15] Variation in chance could be attributed to shared and non-shared environmental factors. For the powerful others sub-scale, genetic setup was found to account for 19% of the variance; shared environment accounted for 10% and

[13]The study is based on the Swedish Adoption Study and the Twin Study of Aging. The sample included 84 pairs of MZ twins separated at an early age and reared apart, 173 pairs of DZ twins reared apart, 129 MZ pairs reared together, and 168 DZ pairs reared together. The mean age of the sample was 58.6 (SD = 13,6). Pederson et al. (1989) used a three-dimensional measure of locus of control, comprising one factor for individual responsibility for the course of one's life, one for responsibility for failures, and a luck factor. The former two might be considered to represent the internal dimension of locus of control.

[14]The analyses by Bullers and Prescott (2001) are based on the powerlessness sub-scale of the Maddi, Kosoba and Hoover (1979) Alienation Test taken from the Virginia Twin Registry.

[15]The measure of health locus of control used in this study is based on the three-factor model by Levenson (1974).

non-shared environment for 70% of the variation (Johansson et al., 2001). Using self- and parents' reports on self-efficacy of 1,394 adolescent twin pairs in Norway, Waaktaar and Torgersen (2013) found that additive genetic factors account for 75% of the variation in self-efficacy. The remaining quarter is explained by non-shared environmental factors and measurement error. Shared environment had no effect. Interestingly, estimates of total heritability differed considerably between self-reports and other informants. Twin's self-ratings of self-efficacy would have yielded a total heritability of 47% whereas maternal and paternal ratings would have yielded heritability estimates of 57 and 72% respectively. Based on mothers' ratings, shared environment would have explained about 14% of the variance in self-efficacy, as opposed to 0% if fathers' or the twins' ratings were used. Given these dramatic differences, the authors caution against taking heritability estimates of single-informant studies at face value (Waaktaar and Torgersen, 2013).

In sum, existing estimates of genetic influence on locus of control or related constructs range between 15% and 75%. Genetic setup does play a significant role, but the size is still rather unclear. If one tried to draw any conclusions on the role of shared environmental factors, it might be, that on average, externality and its sub-dimensions appears to be more susceptible to environmental influences than internality. As Waaktaar and Torgersen (2013) point out, results of one-time single-rater studies should be interpreted with caution. The synopsis of a growing number of genetically informed studies, ideally with measurements at multiple time points and ratings from different family members, will be necessary to gain a better insight into the role of genetic and shared environmental factors in the determination of locus of control. This Chapter aims to contribute to this literature by analyzing information on locus of control from a representative sample of German twins. It also extends the current literature by using an extended family twin design.

Table 7.1: Overview Twin Studies on LoC

Study	**Type**	**Measure**	**Subscale**	**A %**	**C %**	**E %**	**Data-set**	**Age group**
Mosing (2012)	Twin RT	Rotter's LoC		30 (G)		70	Swedish Twin Registry	51-66
Pedersen (1989)	Twin RAT	unclear	Responsibilty	28	0	72	Swedish Adoption Study	58,6
			Res. Failure	35	9	65		
			Luck	0	31	69		
Bullers (2001)	Twin RT	Powerlessness		16	16	68	Virginia Twin Registry	30
Johannsson (2001)	Twin RT	Health LoC	Internal		0		Octo Twin	83.2
			Powerfull Others	19	10	70		
			Luck	0	45	55		
Waatkaar (2013)	Twin RT (multi rator design)	Self-Efficacy	(all raters)	75	0	24	Norway (Registry Data)	12-18
			(Twins)	47	0	53		
			(Mothers)	57	14	29		
			(Fathers)	47	0	28		

Note: The table provides an overview over the twin studies on locus of control and related concepts. Twin RT: Twins raised together; Twin RAT: Twins raised apart and together; (G) is a common genetic factor that includes additive as well as non-additive genetic effects.

7.5 Methods and Data

The empirical analyses in this Chapter are based on data from the TwinLife Study. TwinLife is a representative multi-cohort study of German twins reared together and their extended families (Diewald et al., 2019). Data analyses are based on the 'workhorse of behavior genetics' (Plomin, 2013) - the classical twin design, and the extended family twin design, which avoids some shortcomings of the former. Twin models can be operationalized in different ways. For the present analyses a multiple group structural equation modeling approach was chosen. The theoretical assumptions of the classic and the extended twin design models are briefly be introduced in the following. After that, the TwinLife data-set is introduced and operationalization choices and sample selectivity are discussed.

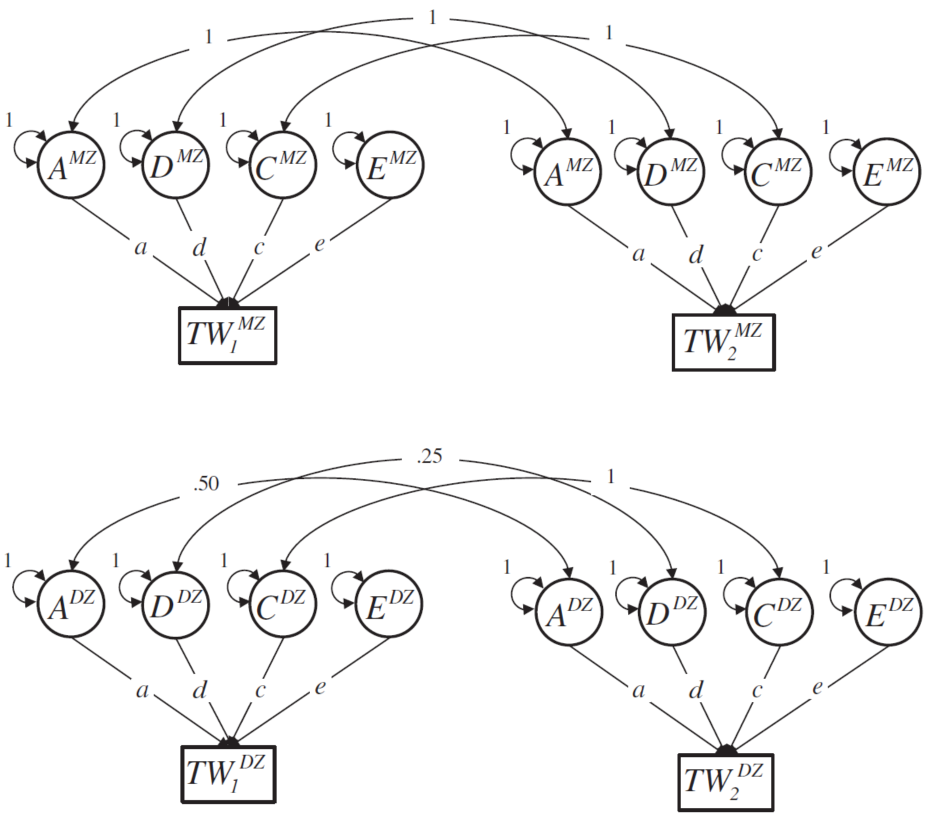
7.5.1 The classical twin-model

The classical twin model studies differences between monozygotic (i.e., identical, MZ) twins and dizygotic (i.e., fraternal, DZ) twins reared together. The method exploits that MZ twins share 100% of their genome, while DE twins share only 50% of their genes, like normal siblings. To the extent that genetic factors influence a certain phenotype, MZ twins should be more similar than DZ twins. The model also makes use of the fact that some environmental influences will be equal for twins, as they grow up in the same household at the same time. Building upon these genetic relations and environmental commonalities, the pattern of co-variation between mono- and dizygotic twins in a measured trait (the phenotype) can be used to decompose the variance in this trait into three causal factors: the proportion of variance that is due to additive genetic effects (A), the proportion of variance that can be explained by shared-environmental factors (C), and the proportion of the variance that non-shared factors can explain, also called non-shared environment (E) and random error (Hill, 2010). The classical twin-model is therefore often referred to as 'ACE' model. However, not all genetic effects are additive. Genetic dominance occurs when genes, which are located at the same place in the genetic code interact in the generative process of a certain phenotype (Plomin et al., 2003). Dominant non-additive genetic effects are captured by a dominance factor (D) in the classical twin model.[16]

[16]If two genes located in different loci of the genetic code interact in producing a phenotype, it is called epistasis (Plomin et al., 2003). Epistasis can not be directly measured in the classical twin model. It can, however, be taken into account by allowing the genetic relationship between dizygotic twins to range between 0 and 0.5 and calculating total genetic influence (G), rather than additive and dominant genetic effects separately (Mosing et al., 2012).

The classical twin model is operationalized using known facts about genetic inheritance to fix patterns of genetic covariance between MZ and DZ twins. For MZ twins, perfect covariation in the genetic factors (A and D) is assumed. By definition, the covariance in the shared environmental factor (C) is also assumed to be perfect. All remaining variance between MZ twins can be attributed to non-shared environmental factors, which are assumed to be uncorrelated. For DZ twins covariance in the additive genetic factor is assumed to be 0.5, as they share only half of their genes. Since genetic dominance requires the interaction between two genes, and each gene has a probability of 0.5 of being shared, covariance for the dominance factor is assumed to be 0.25. As for MZ twins, covariance in the non-shared environmental factor is assumed to be zero. The covariance between shared-environmental factors is again assumed to be perfect. The assumptions underlying the classical twin model are summarized in Figure 7.1.

Figure 7.1: Classical Twin Model



Note: Diagram of classic twin specification where constraints on latent variable covariances reflect relationships among twins (TW); A = additive genetic factor;D = dominant genetic factor; C = common (shared) environmental factors; E = unique environmental factors.

Source: Reprinted from The Leadership Quarterly, Vol 24 / 4,Zyphur, M.J., Zhang, Z., Barsky, A.P. and Li, W.-D., An ACE in the hole: Twin family models for applied behavioral genetics research, p. 577, Copyright (2013), with permission from Elsevier.

The logic behind the variance decomposition model is rather simple: Genetic influence is discovered by comparing the pattern of covariance between MZ and DZ twins. If there were no difference in the covariance between MZ and DZ twins, the genetic factor would be estimated to be zero, and shared environmental factors would be called upon to explain all similarities within twins. In contrast, if the covariation between identical twins were twice as large as the covariation between fraternal twins, all family resemblance would be attributed to additive genetic factors (A), whereas the influence of the shared environment would be estimated to be zero. Phenotype correlations of DZ twins larger than half of the correlation between MZ twins can be attributed to shared-environmental factors (C) (Waaktaar and Torgersen, 2013). Genetic dominance, in contrast, increases the difference in the covariances of MZ and DZ twins. Therefore correlations between MZ twins that are more than twice as large as the correlation between DZ twins indicate dominance effects. Any differences between identical twins must be due to non-shared environmental factors or measurement error. When the phenotype is measured by multiple indicator variables, measurement error can be reduced leading to less biased estimates of non-shared environmental influences (Waaktaar and Torgersen, 2013).

The classical twin model suffers from a number of limitations (Eaves et al., 1978). One major limitation is that additive genetic factors (A), dominant genetic factors (D), and shared environmental effects (C) cannot be estimated simultaneously. There are not enough degrees of freedom to estimate three parameters from two pieces of information (the MZ and the DZ correlation) (Keller et al., 2010). Therefore only two out of the three components can be estimated simultaneously for the classical twin model to be identified. This forces researchers to select one component which is set to zero. The mathematical necessity to constrain one of the components to zero leads to an over-estimation of the influence of additive genetic factors while estimates for dominant and shared environmental effects are likely to be biased downward (Keller et al., 2010).[17]

The validity of the classical twin model rests on two relevant assumptions: First, it assumes that there is no assortative mating with respect to the measured phenotype. If the first assumption is violated, the estimated influence of genetic setup on the measured trait is under-estimated (Bullers and Prescott, 2001). Secondly, it assumes that there is no

[17]This is because genetic dominance and shared environmental effects are negatively confounded (Mosing et al., 2012). While the former increase the difference between MZ and DZ twins, in terms of the MZ-DZ correlation ratio, the latter suppress it.

difference in the exposure towards relevant environmental stimuli for the measured trait between MZ and DZ twins (equal environment assumption, (Scarr, 1968)). If the second assumption does not hold, the influence of genetic factors is over-estimated. While the first assumption is an empirical question that can be tested relatively easily, the second assumption is harder to test. Since MZ twins frequently spend more time together and are perceived to be more equal than DZ twins, the equal environment assumption may not necessarily hold (Bhattacharjee and Sarkar, 2019; Scarr, 1968).[18] Different methods have been devised to assess whether the equal environment assumption holds, including attempts to measure environmental similarity directly (Bhattacharjee and Sarkar, 2019; Kendler et al., 1993). Yet, without knowledge of the environmental factors that are relevant to a particular trait, this method is plagued with uncertainty. A quite sophisticated alternative method uses information on actual and perceived zygosity to compare trait similarity between those who were falsely considered identical or fraternal twins with those for whom perceived zygosity was correct (Scarr, 1968). If equal environmental treatment does not hold, then DZ twins mistakenly believed to be MZ should be more equal in their phenotype than correctly identified fraternal twins.

Finally, the classical twin design does not provide any information on the etiology of shared environmental effects (Kendler and Myers, 2010). Shared environmental effects may be family-specific, but they may also be due to visiting the same school or having common peers. Keller et al. (2010, p. 391) therefore concluded that “if one’s interest is in characterizing the effects of the environment in any way (...) the classic twin model is a singularly bad method”. To be able to compare the results of the present study to existing evidence based on the classical twin design, it will nevertheless be used in this study.

7.5.2 The extended family twin-model

Many shortcomings of the classical twin model can be circumvented when phenotype information is also available for other family members. The *‘extended family twin model’* (sometimes also called *‘nuclear family twin model’*) exploits not only the covariance structure of the twins but also variances in parents’ phenotype and covariances between the twins and their parents and siblings. Modeling the genetic relationships between twins and their

[18] More equal treatment of MZ twins may be a consequence of their more equal genetic setup, which makes them look more equal and behave and react more equal to external stimuli.

parents allows to simultaneously estimate additive (A) and dominant (G) genetic effects and to distinguish between shared environmental effects that are shared between all family members (F) and twin-specific shared-environmental effects (T) (Zyphur et al., 2013).

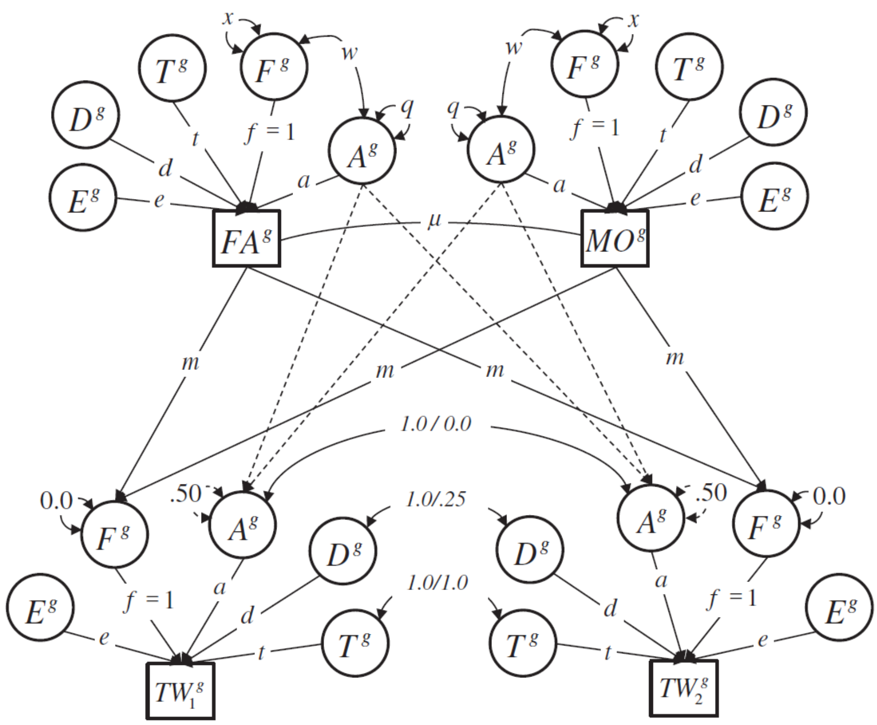
The extended family model exploits the fact that each parent contributes half of the offspring's genetic setup. Each parent contributes one base to the base-pairs, which form the basis of the DNA. This is reflected in extended twin models by setting the paths from parents' additive genetic factor to children's additive genetic factor to 0.5. Which of the parents' alleles is transmitted to the child is randomly determined. This process is called segregation variance (Keller et al., 2009). Therefore, only half of the children's genetic factor variance is explained by the parents' genetic contribution, whereas the other half of the variance is random. For MZ twins, the random part of the variation is perfectly correlated, while for DZ twins, the random part is assumed to be uncorrelated. There is no direct effect of genetic dominance effects from parents to children, as genetic dominance results from a non-linear combination of parent genes. As in the classical twin model, the covariance in the dominance factor is assumed to be 1 for MZ twins and 0.25 for DZ twins. Modeling all the known genetic relationships between parents and children allows attributing the remaining covariance between parents and children to environmental factors, which can then be estimated freely (Zyphur et al., 2013). Effects of parents' phenotype on children's phenotype that are transmitted by environmental means (e.g., by role-modeling) are referred to as 'vertical cultural transmission' (Kendler, 1988). In the model, these are captured by a family-specific factor (F) and a transmission path from parents to children (m).[19] Information on siblings' phenotype can be used to identify elements of the shared environment that are twin-specific (T).[20] The family and twin specific factors can then be combined into a shared environmental factor (C).[21] Moreover extended twin model can account and correct for assortative mating (μ). In addition to that, gene-environment correlations (w) can be captured by freely estimating the covariance between the additive genetic factor and family-specific factor.

[19]"To identify the model, the factor loading f is set to 1.0 and the variance of the family factor F is estimated as x for parents and set to zero for children (i.e., vertical cultural transmission accounts for all family variances for children). The variance x and transmission paths m are identified with non-linear constraints" (Zyphur et al., 2013, p. 582).

[20]Siblings share the same genetic relationships as DZ twins. Differences in the correlation patterns between siblings and DZ Twins are thus due to twin-specific environmental effects, such as cohort effects, peers, and others. "To estimate the twin environmental factor T, covariance among twins for the T factor is set to 1.0, but 0.0 for siblings." (Zyphur et al., 2013, p. 583).

[21]$\mathrm{C} = \mathrm{c}^2 = \mathrm{x} + \mathrm{t}^2$.

Figure 7.2: Extended Family Twin Model



Note: Extended family twin model; hashed lines represent coefficients of .50 (both offspring A variance and effects of parent phenotype on offspring A); Capital letters indicate variables; lower-case letters indicate path coefficients; A = additive genetic factor;D = dominant genetic factor; F = environmental factors common to all family members; T = twin-specific factor shared among siblings; E = unique environmental factors; path coefficients to the left of a / are for MZ twins and to the right of a / are for DZ twins; all variance set to 1.0, except where indicated by estimated path coefficient or 0.0, such as for offspring A factors, where variance is set to.50.

Source: Reprinted from The Leadership Quarterly, Vol 24/4, Zyphur, M.J., Zhang, Z., Barsky, A.P. and Li, W.-D., An ACE in the hole: Twin family models for applied behavioral genetics research, p. 581, Copyright (2013), with permission from Elsevier.

Additive genetic effects in extended twin models are typically smaller than those found when the classical twin design is used (Zyphur et al., 2013). The estimates of the dominant genetic effects are expected to lie between ADE and DCE estimates. Similarly, the estimates of shared environmental effects are expected to lie between those of ACE and DCE estimates.

7.5.3 The TwinLife Study

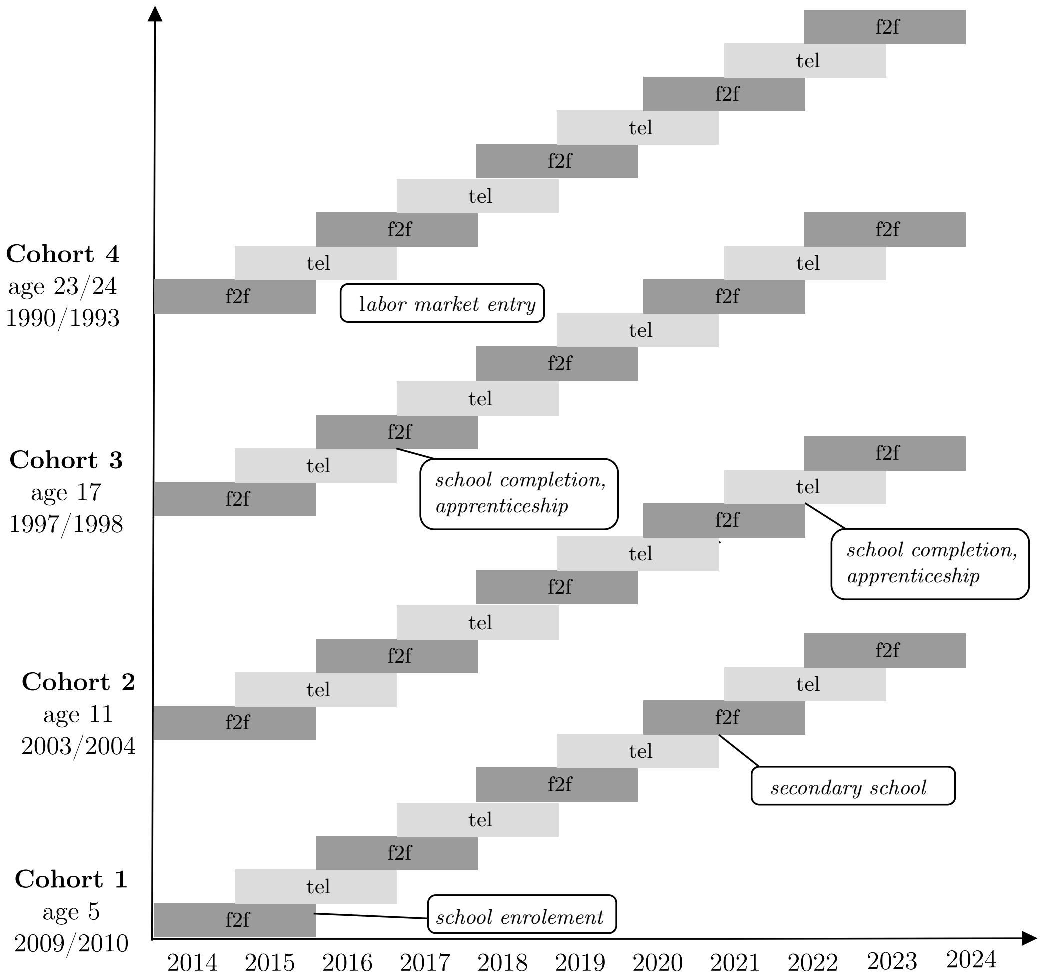
The empirical analyses in this Chapter are based on data from the first two waves of TwinLife (Diewald et al., 2020). TwinLife is a multi-cohort panel study of mono- and same-sex dizygotic twins and their extended families living in Germany. The data-set is particularly apt for this project as it was explicitly designed to enable genetically informed research on the development of social inequalities across the lifespan (Lang et al., 2019). It is the first twin study in Germany that is based on a population-wide sample. Due to a socially stratified sampling-design, the study covers the entire range of the educational, occupational, and income distribution in Germany (Lang and Kottwitz, 2020). With regards to the selected cohorts, the study focuses on important transitions that have been shown to play a key role in the social stratification process from young childhood to early adulthood. While the youngest cohort (Cohort 1, born 2009/2010) was pre-school age at the start of the panel in 2014, the second cohort (born 2003/2004,) aged 11 at panel-start, was just facing the important tracking-choice in the German school system. The third cohort (born 1997/1998) was in their teen years at panel start and about to finish school and start vocational or academic training, while the oldest cohort (Cohort 4, born 1990-1993), which was aged 21 to 24 at panel start, was about to experience the many transitions of early adulthood, such as entering employment. As already mentioned, TwinLife implemented an extended family design. It collects data from the twins themselves and the twins' biological and social parents (i.e., partners of biological parents), as well as the closest sibling aged above 5, and for the older cohorts, partners of the twins themselves. Extended family information enables better estimations of the genetic influence on a certain phenotype and more detailed analyses of the influence of familial background (Keller et al., 2010). Data are collected via face-to-face interviews in the participants' homes every other year. In the years in between, telephone interviews are conducted. A graphical representation of the survey design and survey modes is provided in Figure 7.3.

Lang and Kottwitz (2020) use the German micro-census to assess the representativeness of the initial TwinLife sample with regard to parental education, occupational status, household income and migration background.[22] Their results indicate a small upward bias of the TwinLife sample, in particular with regards to parental education and an under-representation of non-German households, especially in the younger cohorts of TwinLife (Lang and Kottwitz, 2020). They conclude, however, that "since the TwinLife sample covers the whole distributions of the social background indicators, this selectivity does not restrict the usability of the TwinLife sample for social stratified analyses of genetic influences" (Lang and Kottwitz, 2020, p. 148).

[22]The German micro-census is a 1% representative probability sample of the German population.

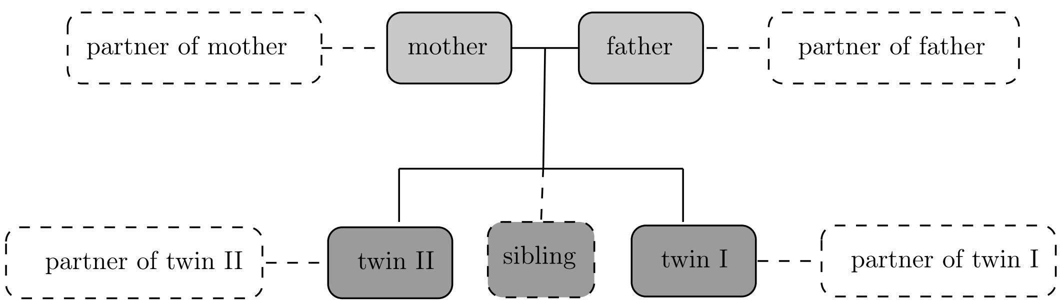
Figure 7.3: TwinLife Study design

(a) Multi-cohort panel design and interview modes



Note: The illustration shows the cohort design and interview modes of the TwinLife Study.
Source: Replicated fromLang and Kottwitz (2017, p. 3) Figure 1.

(b) Extended family design



Note: The illustration shows the extended family design of the TwinLife Study.
Source: Replicated fromLang and Kottwitz (2017, p. 4) Figure 2.

7.5.4 Analysis Sample

The following analyses are based on data from face-to-face interviews in the first and second wave. Information from all birth-cohorts is used, but analyses are run separately for the two younger and the two older birth cohorts. Out of 4.096 initial multiples in the first wave, 11 were triplets were excluded. Another 15 twin pairs were excluded due to missing information on zygosity. Of the resulting 4079 full twin pairs from the first wave, 2704 (66%) participated in the second face-to-face interview two years later. The final analysis sample comprises only twins for which both twins provided valid information on locus of control. This led to the exclusion of another 1097 twin pairs because of item-non-response of at least one of the twins on at least one locus of control item. The remaining 1601 twins pairs for whom there is full information on locus of control make up 40% of the initial sample. Table 7.2 provides an overview of the dropout process.

Table 7.2: Dropout and selection process

	Twin Pairs	Individuals	% 1^{st} wave	% 2^{nd} wave
Sample of multiples in wave 1	4097	8194		
- excluding triplets	4086	8172		
- excluding twin pairs without zygosity information	4079	8158	100	
Sample of full twin pairs participating in wave 2	2704	5408	66.3	100
- excluding twin pairs with incomplete information on locus of control	1601	3202	39.2	59.2

Note: The table provides an overview over the dropout process from wave 1 to wave 2 as well as sample selection based on unit non-response and item non-response with regards to locus of control.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table 7.3 compares the final analysis sample to the initial sample of full twin pairs in some basic demographic characteristics. The final analysis sample comprises 3202 twins (MZ: 45%; DZ: 55%).[23] As Table 7.3 indicates that sample selectivity due to drop out from the first to the second wave and item non-response for locus of control exacerbates the initial bias with regards to parental education and German citizenship. Twin pairs who remain in the sample and provide full information on locus of control tend to have more educated parents, are more educated themselves, and have German citizenship more often.

[23]The over-representation of DZ twins results from the sampling strategy, which aimed to counter the over-representation of MZ twins typically found in twin-samples (Lang and Kottwitz, 2020).

Table 7.3: Selectivity of dropout and selection process

	Wave 1 Sample		Wave 2 Sample		Final Sample	
	Obs	Mean	Obs	Mean	Obs	Mean
By cohort	8,158		5,408		3,202	
Cohort 1	2,008	0.25	1,492	0.28	752	0.23
Cohort 2	2,072	0.25	1,496	0.28	788	0.25
Cohort 3	2,118	0.26	1,304	0.24	928	0.29
Cohort 4	1,960	0.24	1,116	0.21	734	0.23
By Agegroup	8,158		5,408		3,202	
15 and younger	4,080	0.50	2,988	0.55	1,540	0.48
16 and above	4,078	0.50	2,420	0.45	1,662	0.52
By sex	8,158		5,408		3,202	
male(%)	3,698	0.45	2,486	0.46	1,456	0.45
female(%)	4,460	0.55	2,922	0.54	1,746	0.55
By zygosity	8,158		5,408		3,202	
monozygotic(%)	3,750	0.46	2,454	0.45	1,500	0.47
dizygotic(%)	4,408	0.54	2,954	0.55	1,702	0.53
By citizenship (> 15)	4,068		2,415		1,660	
German citizenship (%)	3,882	0.95	2,347	0.97	1,618	0.97
No German citizenship (%)	186	0.05	68	0.03	42	0.03
By region	8,156		5,407		3,201	
East(%)	1,399	0.17	978	0.18	579	0.18
West(%)	6,757	0.83	4,429	0.82	2,622	0.82
highest educational degree (>= 15)	2,284		1,314		865	
no school degree	33	0.01	14	0.01	6	0.01
primary or lower secondary	247	0.11	105	0.08	67	0.08
intermediate secondary	695	0.30	403	0.31	265	0.31
upper-secondary	296	0.13	174	0.13	110	0.13
Abitur	962	0.42	584	0.44	400	0.46
other	51	0.02	34	0.03	17	0.02
monthly personal gross income (>= 15)	1,460	1,227.91	827	1,167.89	571	1,151.83
net equivalent hh-income	7,196	1,659.23	4,858	1,770.73	2,864	1,759.34
Mother's education	3,840		2,571		1,516	
no school degree	78	0.02	29	0.01	17	0.01
primary or lower secondary	535	0.14	257	0.10	149	0.10
intermediate secondary	1,306	0.34	816	0.32	484	0.32
upper-secondary	385	0.10	289	0.11	165	0.11
Abitur	1,484	0.39	1,152	0.45	685	0.45
other	52	0.01	28	0.01	16	0.01
Father's education	2,539		1,791		1,065	
no school degree	48	0.02	28	0.02	16	0.02
primary or lower secondary	417	0.16	232	0.13	133	0.12
intermediate secondary	639	0.25	430	0.24	253	0.24
upper-secondary	355	0.14	256	0.14	159	0.15
Abitur	1,042	0.41	815	0.46	481	0.45
other	38	0.01	30	0.02	23	0.02

Note: The table illustrates the selectivity of the initial sample as well as the dropout process with regards to key demographic characteristics.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

7.5.5 Measurement of constructs

Locus of Control: Locus of control was assessed in the second face-to-face wave for all individuals in the extended family design. TwinLife uses different measurement instruments for locus of control for different age groups. The younger two cohorts of twins and siblings aged 15 or younger received a different set of questions than individuals aged 16 and above.[24] Both instruments contained four items, with two items measuring internal and two items measuring external control convictions. Table 7.4 lists the respective items.

Table 7.4: Locus of Control Items in TwinLife

Locus of Control (15 and younger)
Internal:
It mainly depends on me and my abilities if I am elected as class representative. (loc0100)
How many friends I have depends on me and my behavior. (loc0102)
External:
Even when I make an effort, I seldom get what I want. (loc0101)
Although I am skilled, I am seldom taken seriously by others. (loc0103)
Locus of Control (16 and over)
Internal:
How my life goes depends on me. (loc0200)
One has to work hard in order to succeed. (loc0202)
External:
I frequently have the experience that other people have a controlling influence over my life (loc0201)
The opportunities that I have in life are determined by the social conditions. (loc0203)

Note: The table lists the items used to measure internal and external locus of Control in the TwinLife study for different age groups; All items were assessed on a 5-point likert scale. For individuals aged 15 and younger the Likert scale ranged from not true (1) to true (5). For individuals aged 16 and older, the categories of the Likert scale ranged from fully disagree (1) to fully agree (5). Original item labels are indicated in brackets.
Source: TwinLife Scales Manual. (Baum, 2020).

Table 7.5 lists summary statics for the individual indicator items.[25] The indicators for internal locus of control are negatively skewed, as is usual for locus of control measures. External locus of control is positively skewed for the younger two cohorts, which is according to expectations. Notably, the items for external locus of control among the older cohorts are skewed into different directions: survey respondents did not experience their lives to be determined by powerful others, but they perceived their opportunities to

[24] Both item batteries were adapted from the SOEP items on locus of control (Baum et al., 2020). The short-scale used in the Socio-Economic Panel Study (SOEP) developed by Krampen (1981) builds upon on Levenson's (1981) three-dimensional IPC scale (Schupp and Weinhardt, 2011). For children aged nine and younger, the questions were assessed via computer-aided personal interview. Answers were given by the children themselves. Individuals aged ten and above received a pen-and-paper questionnaire which they completed themselves Baum et al. (2020).

[25] Histograms for the respective items can be found in Figure B.1 in Appendix B.

be determined by social conditions as a whole. The items are nevertheless considered to measure a single dimension of locus of control since both items measure a *social* dimension of external control rather than, for example, pure luck, which is considered a third dimensions in some constructs of locus of control (Levenson, 1974).

Table 7.5: Descriptive Statics on Locus of Control Items in TwinLife

	N	Mean	SD	Var	Min	Max	Skew	Kurt
Internal LoC (15-)								
loc0100	1,540	3.212	1.324	1.754	1	5	-0.280	1.993
loc0102	1,540	3.897	1.177	1.385	1	5	-1.006	3.170
External LoC (15-)								
loc0101	1,540	2.600	1.245	1.549	1	5	0.468	2.210
loc0103	1,540	2.403	1.294	1.675	1	5	0.594	2.252
Internal LoC (16+)								
loc0200	1,662	4.182	0.722	0.521	1	5	-0.980	4.990
loc0202	1,662	4.215	0.703	0.494	1	5	-0.796	4.187
External LoC (16+)								
loc0201	1,662	2.296	0.925	0.855	1	5	0.615	3.020
loc0203	1,662	3.341	0.937	0.879	1	5	-0.401	2.615

Note: The table shows key summary statistics for the unstandardized indicator items of the different locus of control measures.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Exploratory factor analyses were conducted to test whether the items loaded on the latent constructs as intended (i.e., as shown in Table 7.4). For the younger two cohorts, the factor-structure was well aligned with the intended factor structure. Factor loadings on the intended latent factors were relatively low, however, ranging between 0.32 and 0.48. For the older cohorts, the factor analyses revealed relatively high cross-loadings for some of the items (Factor loadings are presented in Table 7.6). In particular the item '*How my life goes depends on me.*' was found to load also on the external dimension.

Scores for the latent constructs of internal and external locus of control were obtained by fitting a measurement model for each age group. As there are only two items per dimension, the variance of the latent constructs was restricted to equal one, and the item loadings were restricted to be equal within each latent variable for the model to be identified. Results for these measurement models are shown in Figure 7.4. The measurement models confirmed the factor structure that was revealed in the factor analyses. For the younger two cohorts,

Table 7.6: Factor structure of locus of control items

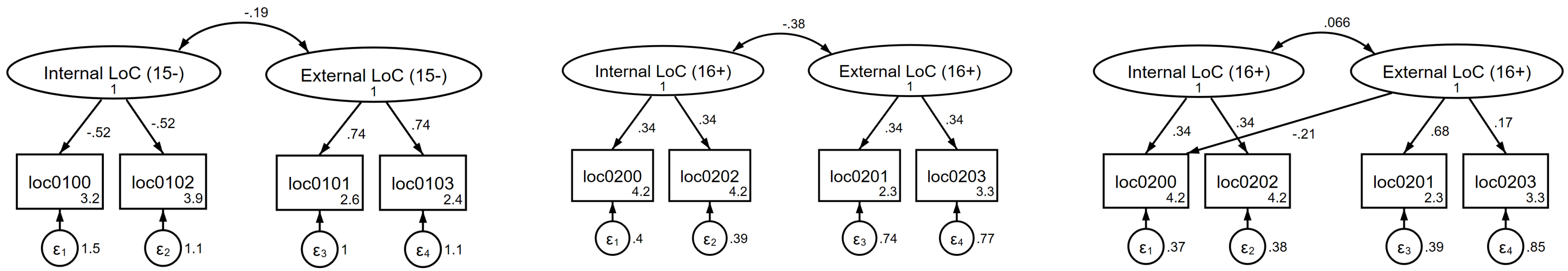
Locus of control (15-)			**Locus of control (16+)**		
Item	Factor 1	Factor 2	Item	Factor 1	Factor 2
loc0100	-0.027	0.318	loc0200	0.382	-0.207
loc0102	0.152	0.315	loc0202	0.361	0.013
loc0101	0.484	0.034	loc0201	-0.112	0.346
loc0103	0.476	0.040	loc0203	-0.077	0.240
N	1,540		N	1,662	

Note: The table shows results for exploratory factor analyses for the locus of control items for both age groups. For both age groups, the two-factor structure is confirmed. For the younger group, the items load onto the two dimensions as expected, with little cross-loadings. For the older cohorts, there are cross-loadings for item loc0200 and loc0201.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

the measurement model, which measured the respective dimensions with the two intended items, achieved acceptable model fit (RMSEA: 0.06; CFI: 0.93). Hence, this model was chosen to construct the latent factor scores for locus of control for the younger cohorts. For the older cohorts, model fit for the intended (two-items per factor) model did not achieve conventional thresholds for model fit (see panel b of the table in Figure 7.4). Therefore, the model was adjusted as suggested by the factor structure in Table 7.6. Allowing an additional path from the external dimension to the first item of the internal dimension (loc0200 'How my life goes depends on me') improved model fit significantly. The adjusted model (Panel c in Figure 7.4) showed a good model fit (RMSEA: 0.04; CFI: 0.99) and was thus selected as a basis for the construction of the latent factor scores for the two older cohorts.[26] Latent constructs were winsorized and standardized. Parental indicators of locus of control were winsorized and standardized separately, to account for age-related changes in mean levels of locus of control.

[26]Error terms were not allowed to correlate between or within latent constructs. Correlation of error terms within latent constructs would mean that something that is not measured and that is not the latent factor of interest affects both observed indicators (Landis et al., 2009). Since it is theoretically unclear what this could be, correlation of error terms within one latent construct was not allowed. Correlation of error terms between latent constructs would mean that there is something that affects indicators of different latent constructs that are not connected to the latent constructs. Here, it seems to make more sense to assume that certain observed indicators may measure both dimensions, rather than assuming some unknown, external source of variance in the observed indicators.

Figure 7.4: Measurement Models for Locus of Control Measures



(a) LoC (15-) (b) LoC (16+) (c) LoC (16+) adjusted

Goodness of fit statistics for Measurement Models

	a) GoF LoC (15-)			b) GoF LoC (16+)			c) GoF LoC (16+) adjusted		
χ^2 (p-value)	23.705	(0.000)		54.136	(0.000)		3.661	(0.000)	
RMSEA (CI)	0.063	(0.041	0.087)	0.101	(0.079	0.126)	0.040	(0.000	0.087)
TLI	0.857			0.438			0.912		
CFI	0.928			0.719			0.985		
SRMR	0.038			0.051			0.015		
CD	0.654			0.506			0.731		

Note: The figure shows graphical representations of the measure models used to construct the factor scores for locus of control in the younger two cohorts (panel a) and the older two cohorts (panel b)). The model in the middle (panel b) which would have been the model that was intended by designers of the TwinLife survey did not achieve a good model fit and was therefore rejected. The table shows a number of fit-indices the for the respective measurement models.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Socio-Economic Background: To account for the multidimensional nature of social status, two indicators are used to proxy for socio-economic background: parental education, and equivalized household income. Dichotomous indicators of socio-economic background are constructed. Parental educational level is coded as high if at least one of the parents has obtained a school degree that allows entry into tertiary education. This is the case for 60% of the twin pairs. Parental income is coded high if net equivalized household income exceeds the median net-equivalized household income in 2016, the year of the survey (1644€ (Bundeszentrale für Politische Bildung, 2018)).[27] Half of the twin pairs in the final sample are from high-income households, while the other half are from low-income households.

7.6 Results

7.6.1 Descriptive Analyses

The data were checked for selective unit- and item-nonresponse. Table 7.7 presents summary statistics for locus of control based on the full sample of the second wave (upper panel) and the restricted analysis sample, which includes only full pairs of twins for whom information on both dimensions of locus of control is available (lower panel). Individuals who remained in the sample were, on average, slightly more internal and slightly less external than those excluded from the analysis because of missing information of their co-twins. The differences between those who were dropped and those who remained were, however, not statistically significant.[28] Hence the sample upon which the following analyses are based is sufficiently similar to the sample for which information was available. Unfortunately, quite a large number of twins had dropped out by the second wave. For these individuals, no information on locus of control is available. Therefore, it remains unclear whether the final analysis sample is biased with regards to locus of control. Information on selectivity of the analysis sample can only be drawn from the socio-demographic variables presented in Table 7.2.

Table 7.8 shows averages of the age-specific locus of control variables by zygosity, sex and socio-economic background. Corresponding t-tests that test for significant differences

[27]The threshold was obtained from an external reference point as the TwinLife Data have been shown to be slightly biased. The median net equivalized household income from within the sample would have been 1667€.

[28]The results for the respective T-Test can be found in Table B.1 in Appendix B.

Table 7.7: Attrition Analysis

Unrestricted Sample

	N	Mean	SD	Var	Min	Max	Skew	Kurt
Internal LoC (15-)	1,911	-0.000	1.000	1.000	-3	2	-0.486	3.006
External LoC (15-)	1,911	0.000	1.000	1.000	-2	2	0.541	2.793
Internal LoC (16+)	1,910	-0.000	1.000	1.000	-3	2	-0.372	3.137
External LoC (16+)	1,910	0.000	1.000	1.000	-2	3	0.552	3.029

Restricted Sample

	N	Mean	SD	Var	Min	Max	Skew	Kurt
Internal LoC (15-)	1,540	0.018	1.003	1.005	-3	2	-0.495	2.986
External LoC (15-)	1,540	-0.003	1.007	1.014	-2	2	0.529	2.759
Internal LoC (16+)	1,662	0.006	0.999	0.997	-3	2	-0.339	3.088
External LoC (16+)	1,662	-0.004	1.003	1.006	-2	3	0.550	2.997

Note: The unrestricted sample contains all information on locus of control from twins, regardless of whether both twins participated and regardless of whether both twins provided information on internal and external locus of control. The restricted sample only contains full twin pairs for whom information on internal as well as external locus of control is available.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table 7.8: Descriptive Statistics by subgroups

	Locus of control (15-)					**Locus of control (16+)**				
		Internal		External			Internal		External	
	N	Mean	SD	Mean	SD	N	Mean	SD	Mean	SD
By zygosity	1540					1662				
Monozygotic	644	-0.013	1.009	0.009	1.025	856	0.015	0.989	-0.038	0.999
Dizygotic	896	0.009	0.994	-0.006	0.982	806	-0.015	1.012	0.040	1.000
By sex	1540					1662				
Male	776	-0.026	0.987	0.004	0.991	680	0.002	0.999	-0.060	0.984
Female	764	0.026	1.013	-0.004	1.010	982	-0.001	1.001	0.042	1.009
By parental education	1318					1426				
Low parental edu	406	-0.002	1.005	0.101	1.008	692	0.089	1.015	0.056	1.024
High parental Edu	912	0.001	0.991	-0.079	0.971	734	-0.036	0.964	-0.071	0.971
By parental income	1398					1454				
Low parental income	608	-0.043	1.012	0.051	1.027	742	0.062	0.990	0.146	1.041
High parental Income	790	0.017	0.978	-0.047	0.992	712	-0.067	0.992	-0.130	0.946

Note: The table shows mean levels and standard deviations in locus of control by different indicators.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

between subgroups can be found in Table B.2 in the Appendix. Mono- and dizygotic twins of all age-groups did not differ significantly in internal or external locus of control. Females in the older cohorts were found to be significantly more external than males (p-value: 0.041). Locus of control appears to vary with social background. Mean levels in internality did not differ by social status for the younger cohort. Children whose parents had low education (p-value: 0.002) or low income (p-value: 0.070) were found to be more external than their peers from high-SES households. In the older cohorts, individuals whose parents had a low education or below-median income were also significantly more external (p-values: 0.017 and 0.000 respectively). In contrast to the expectation, young adults whose parents had above-median income and high education had on average a lower internal locus of control than young adults from the low-socio-economic group (p-values: 0.017 and 0.013 respectively).

Twin correlation structure

Table 7.9 lists correlation coefficients for internal and external locus of control separately for MZ and DZ twins. For the younger cohorts, the correlation pattern suggests significant shared environmental effects for both dimensions of locus of control. For the older two cohorts, the correlation pattern differs for internal and external control expectations. For internal control, the DZ correlation is less than half of the MZ correlation. This indicates genetic dominance effects. For external control beliefs, the DZ correlation exceeds half of the MZ correlation, indicating a significant influence of shared environmental effects.

Table 7.9: Correlations for MZ and DZ Twins

	Monozygotic Twins			**Dizygotic Twins**		
	ρ	p	Pairs	ρ	p	Pairs
Internal LoC (15-)	**0.217**	(0.000)	322	**0.199**	(0.000)	448
External LoC (15-)	**0.399**	(0.000)	322	**0.300**	(0.000)	448
Internal LoC (16+)	**0.272**	(0.000)	428	**0.121**	(0.015)	403
External LoC (16+)	**0.263**	(0.000)	428	**0.169**	(0.001)	403

Note: Correlation coefficients for mono- and dizygotic twins.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

The extended twin model is also uses covariation between other family members. Therefore correlations between different family members are displayed in Tables 7.10 and 7.11.

Table 7.10: Extended Family Correlations - Internal Locus of control (16+)

Internal Locus of Control (16+) for MZ Twins

Variables	**Twin 1**	**Twin 2**	**Mother**	**Father**	**Sibling**
Twin 1	1.000				
Twin 2	**0.272**	1.000			
	(0.000)				
Obs.	428				
Mother	**0.094**	**0.095**	1.000		
	(0.074)	(0.069)			
Obs.	364	364			
Father	**0.063**	**0.117**	**0.150**	1.000	
	(0.306)	(0.056)	(0.020)		
Obs.	267	267	238		
Sibling	**0.049**	**0.069**	**0.210**	**0.147**	1.000
	(0.593)	(0.472)	(0.028)	(0.168)	
Obs.	121	121	110	89	

Internal Locus of Control (16+) for DZ Twins

Variables	**Twin 1**	**Twin 2**	**Mother**	**Father**	**Sibling**
Twin 1	1.000				
Twin 2	**0.121**	1.000			
	(0.015)				
Obs.	403				
Mother	**0.043**	**0.073**	1.000		
	(0.424)	(0.181)			
Obs.	343	343			
Father	**0.170**	**0.048**	**0.179**	1.000	
	(0.010)	(0.464)	(0.008)		
Obs.	233	233	216		
Sibling	**0.156**	**0.106**	**0.093**	**0.166**	1.000
	(0.094)	(0.256)	(0.346)	(0.164)	
Obs.	116	116	105	73	

Note: Pairwise correlations of internal and external locus of control for twins and their parents and siblings. p-values in parentheses. Obs.: Observations.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table 7.11: Extended Family Correlations - External Locus of Control (16+)

External Locus of Control (16+) for MZ Twins

Variables	**Twin 1**	**Twin 2**	**Mother**	**Father**	**Sibling**
Twin 1	1.000				
Twin 2	**0.263**	1.000			
	(0.000)				
Obs.	428				
Mother	**-0.009**	**0.064**	1.000		
	(0.865)	(0.223)			
Obs.	364	364			
Father	**0.075**	**0.083**	**0.118**	1.000	
	(0.223)	(0.175)	(0.069)		
Obs.	267	267	238		
Sibling	**0.056**	**0.202**	**0.000**	**-0.071**	1.000
	(0.515)	(0.026)	(0.998)	(0.509)	
Obs.	121	121	110	121	

External Locus of Control (16+) for DZ Twins

Variables	**Twin 1**	**Twin 2**	**Mother**	**Father**	**Sibling**
Twin 1	1.000				
Twin 2	0.169	1.000			
	(0.001)				
Obs.	403				
Mother	**0.113**	**0.034**	1.000		
	(0.036)	(0.535)			
Obs.	343	343			
Father	**-0.013**	**-0.070**	**0.145**	1.000	
	(0.849)	(0.302)	(0.033)		
Obs.	233	233	216		
Sibling	**0.211**	**0.251**	**0.147**	**-0.073**	1.000
	(0.023)	(0.006)	(0.134)	(0.542)	
Obs.	116	116	105	73	

Note: Pairwise correlations of internal and external locus of control for twins and their parents and siblings. p-values in parentheses. Obs.: Observations.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Unfortunately the correlation patterns are not as consistent across the twin-groups as expected. This may be due to the relatively small size of the final analysis sample. For example, it is difficult to understand why the correlations between first and second-born twins and their parents are so different for mono- and dizygotic twins. Moreover, correlations with siblings and between siblings and parents vary across groups. In general, twin's locus of control is not very highly correlated with that of their parents, or not correlated at all. One reason for the lack of significant correlations between parents and their children might be sex differences in the size (and possibly direction) of the correlation with same- and opposite sex parents. Such differences may cancel out on average, such that no significant correlation pattern is observed. Gender-specific correlation patterns are equally inconsistent, however (see Tables B.4 and B.5 Appendix B for gender-specific correlation tables).

Twin correlation structure by parental SEB

Tables 7.12 and 7.13 show the correlation patterns conditional on parental education and income. Due to missing data on parental SES some twin pairs had to be dropped from the respective analyses.

When SEB is proxied by parents' educational attainment (Table 7.12), the MZ correlation for internal locus of control in the high attainment group is smaller than the DZ correlation in the younger two cohorts, which may indicate measurement problems (albeit the correlation is not significant). In the older two cohorts, genetic dominance is indicated in the high SES group, whereas shared environmental influence is indicated in the low-SES group. For external locus of control, the correlation pattern suggests that shared environmental effects may affect external locus of control more strongly in the low-SES group. This effect is more pronounced in the younger age-group, where parental influence may still be larger. Moreover the fact that MZ-DZ ratio of 0.5 in the older high-SES group suggests that the effects of shared environmental influences on high-SES adults locus of control is close to zero. For older low-SES twins, shared environmental influences seem to continue to affect external locus of control into early adulthood.

When socio-economic background is proxied by equivalized household income (Table 7.13) the correlation patterns for *internality* in the younger group are very similar. House-

Table 7.12: Correlations for twin groups by parental education

	parental Education	**Monozygotic Twins** ρ	p	Pairs	**Dizygotic Twins** ρ	p	Pairs
Internal LoC (15-)	high	**0.117**	0.115	182	**0.193**	0.001	274
	low	**0.389**	0.000	91	**0.259**	0.006	112
External LoC (15-)	high	**0.364**	0.000	182	**0.258**	0.000	274
	low	**0.409**	0.000	91	**0.395**	0.000	112
Internal LoC (16+)	high	**0.215**	0.004	177	**0.083**	0.256	190
	low	**0.222**	0.003	181	**0.146**	0.061	165
External LoC (16+)	high	**0.276**	0.000	177	**0.138**	0.057	190
	low	**0.307**	0.000	181	**0.210**	0.005	165

Note: Correlation coefficients for mono- and dizygotic twins by parental education; high: access to tertiary education, low: no access to tertiary education.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table 7.13: Correlations for twin groups by parental income

	parental Income	**Monozygotic Twins** ρ	p	Pairs	**Dizygotic Twins** ρ	p	Pairs
Internal LoC (15-)	high	**0.191**	0.012	171	**0.186**	0.005	224
	low	**0.187**	0.037	126	**0.178**	0.018	178
External LoC (15-)	high	**0.492**	0.000	171	**0.310**	0.000	224
	low	**0.270**	0.002	126	**0.274**	0.000	178
Internal LoC (16+)	high	**0.249**	0.001	177	**0.182**	0.015	179
	low	**0.280**	0.000	193	**-0.006**	0.937	178
External LoC (16+)	high	**0.149**	0.048	177	**0.086**	0.250	179
	low	**0.330**	0.000	193	**0.172**	0.021	178

Note: Correlation coefficients for mono- and dizygotic twins by parental income; high: above median income, low: below median income.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

hold income thus does not seem to affect the degree to which internality is genetically and socially produced in young children. For the older two cohorts, the MZ-DZ correlation ratios suggest that there are such differences: For adult twins from high-income households shared environment is suggested to have significant effect. For adult twins from low income households internality is no longer significantly correlated, pointing to strong idiosyncratic influences on internality. For *external locus of control*, the correlation pattern for the younger two cohorts suggest considerable shared-environmental effects in both income groups. The influence of shared-environmental factors seems to be larger in the low-SES group, however. The difference in the degree to which MZ twins resemble each other in low and high income households may indicate the existence of gene-environment interaction effects. For the older two cohorts, shared environmental effects do not seem to play a large role, irrespective of parental income. Nevertheless, the correlations in the low-SES group are roughly double the size of those in the high SES group. This may point to a mechanism of social triggering. This means that the social environment determines the degree to which genetic factors for externality are expressed.

Education and income are two relatively different types of resources. It is not unsurprising that different patterns have emerged when approximating parental social status by household income and by parental education. If anything one could refer from the patterns described above, that the genetic and social determination of internality is less affected by social status than that of externality. It seems that externality is more subject to shared environmental effects and there might be a gene-environment interaction in the form of social-triggering for external control beliefs. Particular social contexts may affect whether and to what extent genetic determinants of externality are expressed or not.

7.6.2 Twin Model Results

Model Assumptions of the classical twin model

At first, model assumptions should be checked. The data suggest that partners are more alike to each other in their locus of control orientations than randomly selected individuals. Moreover, internality seems to be more relevant than externality in selecting one's spouse (see Table 7.14). Hence, the assumption of no assortative mating is not fulfilled. This means that estimates of genetic effects in the classical twin model are likely to be biased downward (Bullers and Prescott, 2001).

Table 7.14: Assortative Mating of Parents

	Internal LoC			External LoC		
	ρ	p-value	Obs.	ρ	p-value	Obs.
Twins (15-)	**0.114**	0.008	541	**0.091**	0.035	541
Twins (16+)	**0.162**	0.001	454	**0.134**	0.004	454

Note: The table shows the degree of assortative mating parents of twins, separately for the two age groups.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Theoretically, information on actual and perceived zygosity could be used to assess whether the equal environments assumption is fulfilled. While the TwinLife study does collect information on perceived and actual zygosity, there are only 4 twin pairs in the sample for whom zygosity was incorrectly perceived. Hence, the fulfillment of this assumption could not be checked within the present dataset.

Results for the Twin Models

Results for the twin models are reported separately for the age groups in Tables 7.15 and 7.16. The extended family design was only applied to the older two cohorts, such that the locus of control measure for parents and the twins were the same. Siblings were only included if they also received the same set of items. Where the full twin models indicated that more parsimonious models might fit the data well, these nested models were also estimated. Chi-square difference tests and log-likelihood tests were used to guide model selection. All estimates were conducted in Mplus 8.0 using a maximum likelihood estimation procedure. The results indicate that the factors that determine a person's locus of control change considerably between childhood and young adulthood.

For children, shared-environmental factors appear to play a significant role in determining locus of control. Genetic setup, seems to be less important. For internality, the best model fit was achieved by the nested CE model, which models locus of control as a function of shared- and non-shared environmental influences, assuming that genetic setup does not contribute to internality in childhood. According to this model roughly one fifths of the variation in children's internal locus of control is explained by shared-environmental factors. The other 80% are explained by non-shared environmental factors. For children's external locus of control beliefs, the ACE and DCE models fit the data equally well. Both models attribute 62% of the variation in externality to non-shared environmental factors. As explained above the unbiased influence of the other factors is likely to lie somewhere in between the estimates attained by ACE and DCE model (Zyphur et al., 2013). Hence, the contribution of additive genetic factors to children's externality is likely to lie between 14% and 42%. Non-additive genetic factors are likely to another couple of percentage points in the single-digit-range to the heritability of external locus of control. Shared-environmental factors are likely to explain roughly one fourth of the variation in children's externality.

In young adulthood, best model fit was obtained by the extended twin model, which is likely to yield less biased estimates. For internality, the extended twin design was the only model that fit the data well. The second-best fit is provided by a nested AE model - hence indicating that the variation in internality in young adults is mostly explained additive genetic, and shared-environmental effects. For the externality, the classical twin models achieved a sufficient model fit on some of the model fit indicators, but not all of them (RMSEA). The extended twin model performs best in terms of the RMSEA but TLI and CFI are below the recommended threshold of 0.95. As expected, the size of the influence of additive genetic effects decreases when all genetic factors are estimated freely. In contrast to what was indicated by the correlation structure, genetic dominance was not found to affect internal locus of control. For externality, the estimated absence of the dominant effects is in line with the expectations. Twin-specific shared environmental factors - which may include shard environment within the family and outside of it - explain roughly 5% of the variation in both dimensions. Non-shared environmental factors explain 80% of the variation in internality and externality. Total heritability, which is thus purely based on additive genetic effects, is estimated be 16% for internality and 17% for externality. There was no evidence for vertical cultural transmission of internality (m: b = 0.007, se = 0.033; p-value = 0.841) and externality (m: b=-0.045; se = 0.032; p-value = 0.145). This means that role-modeling by parents is not likely to be one of the factors shared by twins that affects their locus of control beliefs. Moreover, no evidence of gene-environment correlation is found in the extended twin model.[29] (The full results for the extended twin design and non-squared results for the classical twin models can be found in the Appendix in Table B.7.)

[29]The correlation of the family-specific component with parent's additive genetic component (w) is not significant.

Table 7.15: Twin Model for Children

	Internal LoC (15-)				**External LoC (15-)**			
Model	**CE**	**ACE**	**ADE**	**DCE**	**CE**	**ACE**	**ADE**	**DCE**
	b	b	b	b	b	b	b	b
	se	se	se	se	se	se	se	se
Components								
A		**4%**	**26%*****			**14%**	**42%*****	
		14%	4%			12%	4%	
C	**21%*****	**18%$^{+}$**		**19%****	**34%*****	**24%****		**29%*****
	4%	10%		6%	4%	10%		6%
D			**0%**	**2%**			**0%**	**9%**
			0%	9%			0%	8%
E	**79%*****	**78%*****	**74%*****	**78%*****	**66%*****	**62%*****	**58%*****	**62%*****
	4%	6%	5%	6%	3%	5%	4%	5%
h^2		**4%**	**26%*****	**2%**		**14%**	**42%*****	**9%**
		14%	4%	9%		12%	4%	8%
Fit Staticists								
RMSEA	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.000
RMSEA CI	0.000 0.000	0.000 0.000	0.000 0.060	0.000 0.000	0.000 0.055	0.000 0.054	0.000 0.092	0.000 0.054
SRMR	0.016	0.015	0.030	0.015	0.042	0.037	0.048	0.037
CFI	1.000	1.000	1.000	1.000	1.000	1.000	0.959	1.000
TLI	1.056	1.055	1.017	1.055	1.006	1.008	0.983	1.008
LL (H0)	-2167.086	-2167.054	-2168.571	-2167.054	-2137.310	-2136.638	-2139.571	-2136.638
LL (H1)	-2166.756	-2166.756	-2166.756	-2166.756	-2137.310	-2135.126	-2135.126	-2135.126
df	6	5	5	5	6	5	5	5
χ^2 Test	0.660	0.595	3.629	0.595	4.369	3.024	8.891	3.024
p-value	0.995	0.988	0.604	0.988	0.627	0.696	0.114	0.696
Twin Pairs								
MZ	322				322			
DZ	448				448			

Note: Twin Models based on SEM estimations. Models are named according to the estimated components. The components indicate the variance in the observed variable (internal and external locus of control of the older two cohorts) which can be explained by: A: additive genetic factor (= a^2), C: shared environmental factor (= c^2), D: dominant genetic factor (= d^2), E: non-shared environmental factor (= e) and measurement error; h^2 broad sense heritability, including additive and genetic effects. In the ACE, ADE and DCE models a is not adjusted for assortative mating. Non-squared results for the classical twin models can be found in the Appendix in Table B.6. *** p-value: ≤ 0.001, ** p-value: ≤ 0.01, * p-value: ≤ 0.05, $^{+}$ p-value: ≤ 0.10.
Source: Own calculations based on TwinLife V.3.0 and 2 pre-release version.

Table 7.16: Twin Model for Young Adults

	Internal LoC (16+)					**External LoC (16+)**			
Model	**AE**	**ACE**	**ADE**	**DCE**	**Ext. Tw.**	**ACE**	**ADE**	**DCE**	**Ext. Tw.**
	b	b	b	b	b	b	b	b	b
	se	se	se	se	se	se	se	se	se
Components									
A	**27%***	**27%***	**17%**		**15%***	**19%**	**28%***		**17%****
	4%	4%	20%		6%	13%	4%		6%
C		**0%**		**6%**	**4%**	**7%**		**13.7%****	**5%**
		0%		7%	6%	11%		7%	6%
D			**10%**	**21.3%****	**0%**		**0%**	**13%**	**0%**
			21%	9%	1%		0%	9%	0%
E	**74%***	**74%***	**73%***	**73%***	**80%***	**75%***	**72%***	**74%***	**78%***
	4%	4%	5%	5%	4%	5%	4%	5%	4%
h^2	**27%***	**27%***	**17%**	**21%****	**16%***	**19%**	**27.6%***	**13%**	**17%****
	4%	4%	20%	9%	6%	13%	4%	9%	6%
Fit Staticists									
RMSEA	0.047	0.056	0.055	0.066	0.017	0.000	0.000	0.000	0.027
RMSEA CI	0.000 0.088	0.010 0.099	0.007 0.098	0.022 0.113	0.000 0.044	0.000 0.058	0.000 0.062	0.000 0.058	0.000 0.050
SRMR	0.052	0.052	0.052	0.052	0.057	0.036	0.038	0.036	0.073
CFI	0.850	0.823	0.829	0.802	0.947	1.000	1.000	1.000	0.864
TLI	0.950	0.929	0.932	0.901	0.959	1.013	1.008	1.013	0.896
LL (H0)	-2339.075	-2339.075	-2338.963	-2338.959	-4354.284	-2336.036	-2336.285	-2336.036	-4357.882
LL (H1)	-2333.311	-2333.311	-2333.311	-2333.311	-4339.716	-2334.196	-2334.196	-2334.196	-4340.823
df	6	5	5	5	26	5	5	5	26
chi^2 Test	11.527	11.527	11.304	11.295	29.135	3.680	4.178	3.68	34.119
	0.073	0.042	0.046	0.023	0.305	0.596	0.524	0.5963	0.132
Twin Pairs									
MZ			428				428		
DZ			403				403		

Note: Twin Models based on SEM estimations. Classical twin models are named according to the estimated components. The components indicate the variance in the observed variable (internal and external locus of control of the older two cohorts) which can be explained by: A: additive genetic factor (= a^2), C: shared environmental factor (= c^2), D: dominant genetic factor (= d^2), E: non-shared environmental factor (= e) and measurement error; h^2 broad sense heritability, including additive and genetic effects. In the ACE, ADE and DCE models a is not adjusted for assortative mating. Ext. Tw.: extended twin design. The extended twin design does adjust for assortative mating. The full results for the extended twin design and non-squared results for the classical twin models can be found in the Appendix in Table B.7. *** p-value: ≤ 0.001, ** p-value: ≤ 0.01, * p-value: ≤ 0.05, $^+$ p-value: ≤ 0.10.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

7.7 Discussion

This Chapter set out to assess genetic and social influence on locus of control in mid-childhood and young adulthood using the classical, as well as the extended family twin model. The results indicate that in younger ages, shared-environment seems to play a greater role than in young adulthood. The findings indicate that in childhood, internality is entirely socially determined. Externality is mostly socially determined, albeit genetic influence is likely to lie between 14% and 42%. In young adulthood, non-shared social environmental factors become even more important. Non-shared environmental factors explain roughly 80% of the variation in internality and externality in young adults. Almost all of the remaining variation in internal and external locus of control can be attributed to genetic factors. Only about 5% of the variation was explained by shared-environmental factors.

The punchline of the analyses is: Locus of control is mostly socially constructed. It is learned - not inherited. It is a belief, and a skills, rather than a trait. This is in line with the expectation that social factors would be more important in the determination of locus of control than in other traits. Twin-studies on the heritability of the Big Five traits, for example, found higher levels of heritability raging between 40% and 60% (Jang et al. (1996): Neuroticism: 41%, Extraversion: 53%, Openness: 61%, Agreeableness: 61%, Conscientiousness: 44%; Loehlin et al. (1998): Neuroticism: 58%, Extraversion: 57%, Openness: 56%, Agreeableness: 51%, Conscientiousness: 52%).[30] This finding is line with the low rank-order stability found for locus of control (also compared to the Big Five) discussed in Chapter 3.4.2. The high degree of environmental influence on locus of control makes also sense when one considers that locus of control is thought to be a belief that emerges from a generalization of one's own history of experiences.

Almost all of the environmental influence was estimated to be due to non-shared environmental effects and measurement error. For adults, shared environmental influence hardly played a role in explaining variance in internal or external locus of control in adulthood (5%). In this respect, locus of control is not different from other personality traits measured in the Big Five (Jang et al., 1996; Loehlin et al., 1998). In fact, "most envi-

[30] For non-psychological traits such as high, heritability estimates are even higher ranging around 80% for men, and slightly lower for women (Silventoinen et al., 2003).

ronmental influence for most traits is non-shared" (Plomin and Daniels, 2011, p. 538). At first sight, this may seem to contradict the main social-science paradigm, which puts an emphasis on the impact of the family characteristics, socialization and institutions on children's development (Udry, 1995). However, the non-significance of the shared environmental factor in twin-studies, would be wrongly interpreted if one concluded from this that the family environmental effects, or other shared environments are not important! They may well be important, but they may affect individuals in idiosyncratic ways. Differential perceptions of shared environment and reactions to it, may be an important source of non-shared environment (Plomin et al., 2001). The same event (e.g. parental unemployment, or parental disinterest in the child) may be perceived differently and spark different reactions leading to different experiences within the same family.

This shows once again the importance of gene-environment interactions and gene-environment correlations. There is a considerable body of research that is concerned with the effects of children's genetic setup on environmental factors. Ayoub et al. (2019), for example, found that 30% to 40% of the variation in parental warmth and stress was attributable to children's genetic setup. Hence, children may not only perceive equal environments within the same family differently, but also create different environments.

7.7.1 Comparison with existing empirical evidence

How do these results compare to existing literature? In terms of age, the present sample is most comparable to the sample used by Waaktaar and Torgersen (2013) (12-18). Their study was based on a measure of general self-efficacy, however. The measure they used is a set of items starting with 'How well can you ...?' and thus has a slightly different focus. Their heritability estimates are much larger than what other studies suggested for similar traits. The authors explain their high heritability results by their improved multi-rater trait measurement. Buller and Prescots' (2001) study on powerlessness in a relatively young sample (mean aged 30) found that additive genetic factors explained 16% of the variation in powerlessness and hence is very close to the estimate found in this study (17%). Their estimate of the contribution of shared environmental factors is greater than in this study. This is somewhat surprising since the classical twin design typically yields lower shared-environment estimates than the extended twin design used in the present study (Zyphur et al., 2013).

Two twin studies based on samples older twins also found that the largest part (70%) of the variation in locus of control or some dimension of it is due to non-shared environment (Mosing et al., 2012; Pedersen et al., 1989). Yet, considering that the patterns of heritability are known to change across the life-span, is not necessarily comforting. More research is required on the age-dependence of genetic and environmental influences on locus of control. If all of the changes in this pattern occur during adolescence, this might explain the similarity of the results in the present study with the Swedish one.

With regards to changes across the life-course the existing evidence suggest that genetic influences on locus of control replace shared familial influences on locus of control over time. In this respect, locus of control seems to differ from other personality traits. Review studies suggest that the heritability of personality decreases with age (Briley and Tucker-Drob, 2017). Locus of control thus seems to be more akin to intelligence, than to personality traits. Several meta-analyses on genetic and environmental effects on intelligence yield that intelligence is characterized by "significant shared environmental influence in childhood that diminishes to insignificant levels by adolescence to be subsumed by genetic and non-shared environmental influences" (Plomin and Daniels, 2011, p. 583).

7.7.2 Limitations

The analyses in this chapter are subject to several limitations. The largest limitation is probably the relatively small fraction of the sample of twins that could be included into the analyses. More than half of the original sample could not be included, either because they had dropped out by the second wave of the study, or because they had not provided information on the locus of control items. This has two repercussions: On the one hand, statistical power is lost. On the other hand, bias is introduced through self-selection. Those who remained in the sample and answered all questions are more likely to be be of higher-status origin and have a higher status themselves. If genetic and social-determination of locus of control differs across social class, the self-selection may lead to biased results. The low sample size also precluded checking whether central assumptions of the models that were employed hold. Therefore it remains unclear how large the over-estimation of genetic factors is because MZ twins are treated more equally than DZ twins.

Ideally, analyses should have been run separately for each cohort. Considering that locus of control changes substantively during middle-childhood and young adulthood, analyzing children aged 6-8 with children in their early teens (12-14) is not ideal. The life-chances that occur in the nine years between 18 and 27, the age period covered by the older two cohorts, are also likely to affect the processes through which locus of control is formed significantly. Moving out of the parental household, possibly into different places, it seems obvious that shared-environmental factors play less of a role in later stages of the life-course. Hence, more accurate estimates might have been attained by analyzing the cohorts separately. Separate analyses would, however, have reduced the precision of the estimates further.

Another limitation is the low quality of the phenotype measurement. The measurement model fit indices barely reached recommended thresholds and adjustments had to be made to the intended factor structure. Factor loadings were relatively low. A more comprehensive measurement of the trait might have increased the precision of the analyses.

On a more general level, it has also been questioned whether results from twin studies can be generalized to the non-twin population at all (Bouchard and McGue, 2003). The authors argue that growing up as a twin is a fundamentally different experience that may not be comparable to growing up as a non-twin. Twins may be eager to identify with each other increasing similarities, or they may aim for more individual identity, exaggerating differences. Depending on which of the two is more important, self-reports of twins, as well as their parents may be biased. Therefore it is important to complement the results of twin studies with results from adoption studies.

7.7.3 Recommendations for further research

The evidence reviewed in this chapter, and the analyses conducted above suggest that the degree to which locus of control is genetically determined changes across the life-course and varies substantially by sub-dimension and by the rater. Hence, researchers should be careful to generalize results that are based on particular samples. In particular during childhood and adolescence, age-specific studies are necessary. Traits should be defined as precisely as possible and measured accurately. Including phenotype information from family members will allow extended twin family designs that yield less biased results. Hence, moving forward extended twin designs as the one chosen by TwinLife seem most promising to yield reliable results. Moreover, it will be necessary to triangulate evidence obtained from twin studies with evidence from adoption studies.

To solve the problem of identifying differential non-shared environmental influences of shared environments, Plomin and Daniels (2011) suggest using multivariate genetic analyses. Multivariate genetic analyses incorporate environmental measures as predictors into variance-decomposition models. This allows investigating the aetiology of covariance between environmental measures and outcomes. Such analyses could explain to what extent a certain environmental factor (e.g., parental education) is related to a particular phenotype (locus of control) via genetic, non-shared and shared environmental factors.

7.8 Practical implications and conclusion

This chapter sought to identify the importance of genetic and environmental factors in determining internal and external locus of control in childhood and young adulthood. The study extended existing literature by using the classical twin design on a novel data, the TwinLife data. Moreover this is the first study to apply the extended family twin design, which allows a less biased estimation of the influence of genetic and environmental factors on a phenotype (Zyphur et al., 2013). to identify genetic and social contributions to locus of control young adults. The results indicate that the contribution of genetic and environmental factors differs considerably between mid-childhood and young adulthood. In mid childhood, shared environmental factors explain roughly one fourth of the variation in externality and one fifth of the variation in internality. The rest was attributed to shared-environmental factors. For young adults, shared environmental effects no longer explained a significant part of the observed variation internality and externality. The importance of the non-shared environment had even increased, now explaining roughly four-fifth of the observed variation in internal and external control beliefs. Additive genetic factors explained 15% of the variation in internality, and 17% of the variation in externality. Non-additive genetic effects were not found. Since classical twin studies tend to over-estimate genetic effects, the lower estimate of the contribution of genes derived here are in line with expectations. The relatively high estimate of the importance of non-shared environmental factors, should not be taken to indicate that the family environment is not important.

This is because shared environmental factors may have non-shared environmental effects. Children may perceive shared environments differently and react differently towards them. The importance of gene-environment interactions cannot be stressed enough. There are no one-way roads in this research.

The information obtained on the genetic and social determination of locus of control is relevant to assess the degree to which differences in locus of control in children are undeserved, either because they are genetically determined, or due to the socio-economic conditions in which children grew up. Both causes would warrant normative claims on the basis that they obstruct equal access to advantage. On a more practical level, the information is relevant, to assess the opportunities for reducing unequal access to advantage by targeting locus of control beliefs through interventions. The opportunity to do so is limited to the extent that locus of control is genetically determined. The present results, and several previous studies suggest that locus of control is more the result of an individual learning process than of genetic determination. This implies that social-class differences in locus of control may be reduced through targeted interventions. Locus of control seems to be a particularly good target for intervention studies, since it is such a high level trait and since it is less genetically determined that other traits that have bee connected to status outcomes, such as Conscientiousness. All of this sets the stage for further investigations into the ability to change locus of control through intervention.

Chapter 8

Effects of low-intensity mentoring on locus of control

8.1 Motivation, research aims and contribution

The empirical analyses of the preceding chapter and the literature reviewed therein indicate that non-shared environmental factors play a significant role in shaping locus of control. It is still relatively unclear which aspects of the non-shared environment affect the formation and development of locus of control.[1] Therefore, *this chapter is dedicated to one potential aspect of the non-shared environment* that may be particularly relevant in the context of social ineuqality: the presence of extra-familial social support systems.

Resilience research regards the presence of external social support systems to be one out of three clusters of protective factors that moderate detrimental effects of low-SES backgrounds on cognitive, psycho-emotional and physical development.[2] The extra-familial social support networks investigated by resilience researchers are mostly informal social support networks that evolved naturally. Much less is known about the effectiveness of *organized social support relationships* in mitigating the negative effects of adverse environments on human capital development. It is not clear whether organized social support

[1] The gap between the high degree of determination of trait-like characteristics through non-shared environmental factors and the relative lack of knowledge of the specific influencing factors therein is also referred to as 'missing environmentality' (Bratko et al., 2017).

[2] These three clusters are are a) socio-emotional abilities and dispositional features of the child b) family characteristics such as cohesion, and consistency of rules, and c) the availability of external support systems including identification models and mentors (Garmezy, 1993; Masten and Garmezy, 1985). Locus of control has been found to be one of these dispositional features of the child. Other examples are self-esteem, optimism, and humor.

is equally effective in mitigating adverse effects as social support that evolves naturally. Evidence on the evidence of institutionalized and organized social-support is, however, necessary to assess the usefulness of such initiatives in reducing inequality of opportunity.

This chapter uses data from the briq Family panel, a randomized intervention study that paired 212 children from low-SES household with a personal mentor for one year, to assess *the causal influence of a formalized low-intensity mentoring program on the formation of locus of control in low-SES children.* The treated children are compared with a control group of low-SES children that did not receive mentoring and another control group of children from more privileged, middle to upper class households. Due to randomized allocation into treatment and control group the study design allows for a causal interpretation of the results. In particular, the following questions are investigated:

1. *Are the control convictions of children from-low-SES households different from those of children from high-SES households?*
2. *Does formalized low-intensity mentoring affect locus of control in middle-aged children from low-SES-families?*
3. *Can children with an initially higher internal locus of control profit more from low-intensity mentoring?*
4. *Does low-intensity mentoring moderate the effects of socio-economic background on locus of control in middle-aged children?*

The first question investigates whether there is a social gradient in locus of control before the intervention. The second question contributes to the literature on the effectiveness of a particular type of low-intensity mentoring intervention on locus of control in mid-childhood. The study thereby contributes to the literature on extra-familial determinants of locus of control. At the same time it extends the literature on sensitive and critical periods in the development of locus of control and contributes to the literature on skill-development(Cunha and Heckman, 2007). The third question provides relevant insights concerning the self-productivity of locus of control and thus also contributes to the literature based on the theory of skill production. The fourth question concerns additional mechanisms through which the mentoring intervention might benefit low-SES children. By explicitly investigating the effect of the intervention on the impact of background variables, it goes beyond many evaluations of intervention programs, which typically assume independent effects from background variables and the treatment (Heckman et al., 2013).

So far sociological research on contextual influences on locus of control has mostly focused on the family environment. Besides socio-economic characteristics of the family, particular focus has been attributed to parenting styles and parenting behavior (see Chapter 5). Extra-familial contextual factors on locus of control have remained under-researched in sociology and other fields. As a consequence, relatively little is known about extra-familial influences on locus of control. One noteworthy exception is a study by (Ahlin and Lobo Antunes, 2015), who consider both familial, peer, and neighborhood effects on locus of control in children and youth growing up in different neighborhoods in Chicago. In this study, the majority of the investigated local context indicators did not have a significant effect on locus of control, with one exception: Having peers who showed deviant behavior was found to have a negative effect on internal locus of control, independent of family SES and neighborhood characteristics. Other studies indicate that being victimized by peers at school or online increases external locus of control and reduces self-efficacy (Catterson and Hunter, 2010; Fredstrom et al., 2011). This study makes a relevant contribution to the scant sociological literature on extra-familial effects on locus of control by investigating the effects of a formalized mentoring relationship on locus of control.

Compared to sociology, clinical psychology has investigated extra-familial influences on locus of control and the ability to affect locus of control through active intervention more rigorously. Within the cognitive-behavioral framework, changes in locus of control or related concepts are one major target for cognitive-behavioral interventions. To test the hypothesized mechanisms of clinical interventions, clinical psychological studies sometimes also investigate the extent to which locus of control or related concepts mediate and/or moderate the internvention's effectiveness.These studies are, however, often based on small and very specific clinical samples such that their results cannot easily be generalized to non-clinical populations.[3] Further randomized control experiments based on non-clinical populations are needed. This study provides an investigation of the effect of a randomized controlled intervention study on locus of control that targets a non-clinical population.

[3] A few examples for this type of studies are Even et al. (2010); Mehrtak et al. (2017); Reynaert et al. (1995); Smith (1989).

The present study also extends previous literature in testing explicitly the effectiveness of a *low-intensity* mentoring program. Various studies demonstrated that intervention programs aimed at enhancing developmental and schooling outcomes were more effective when the entire family system, rather than just the child, was targeted (Greenberg et al., 2001; Shucksmith et al., 2010). Targeting the entire family, however, is costly and requires active involvement and agreement from the entire family. Both features of these effective intervention programs bear risks: Prohibitively high costs may impede large-scale implementation and due to the need for parents to also engage in the program, those children, in the least favorable conditions, who would benefit the most from the program might be left out. Therefore it is necessary to investigate the effectiveness of less demanding intervention programs that can be introduced at lower costs per case. The results of this study relevantly complement the information gained from high-intensity intervention studies. Another benefit of this study is that it can test whether the intervention has changed the children's locus of control beliefs in on the long run. A better understanding of the long-term effectiveness of low-intensity means, is a relevant prerequisite for policy makers and practitioners in designing programs that foster equality of opportunity by disconnecting individuals' life-chances from their parents' social-status.

8.2 Theory and Hypotheses

The theoretical reflections in Chapter 5 indicate that individuals who grow up in low-SES households have more external (less internal) control perceptions. It a reduction in of the social gradient in locus of control is the aim, it should first be established that such a social gradient exists. Therefore, the first hypothesis is that children from low-SES households differ in their control perceptions of children in high-SES households.

> `H1:` *Children from high-SES households have a more internal (less external) locus of control than children from low-SES households.*

The core question of this chapter is whether low-intensity mentoring affects locus of control in low-SES children. As in the general theory (see Section 5.3) mentoring is hypothesized to affect locus of control via all three sources of learning posited by social learning theory (Bandura, 1977a). Before considering these pathways in more detail, a brief note on the expectation of mentors' locus of control orientation is reasonable.

A relevant aspect of the learning process that may take place in the mentoring setting is the mentors' locus of control orientation. Mentors are expected to have high internal locus of control convictions due to self-selection effects. Individuals who voluntarily enter a mentoring relationship are likely to simultaneously hold a number of beliefs, which jointly indicate a high degree of internality (low degree of externality).

Only individuals with an internal attribution style will think of themselves as potential mentors. Individuals who think that their experience might benefit others are likely to perceive themselves as successful in some relevant respect and to attribute this success at least partly to their own convictions, choices, and behaviors, rather than to pure luck. [4] Out of this group of individuals, only those are likely to become mentors, who, at the same time, believe that individuals *in general* can affect the course of their fate. Entering a mentoring relationship as a mentor makes particular sense against the background of an internal locus of control orientation. This is even more true if the mentoring relationships is explicit and institutionalized. In this case, the mentor enters the mentoring relationship actively and consciously.[5] Hence, especially in institutionalized, explicit, voluntary contexts, where the motivation to become a mentor is intrinsically driven, mentors can be expected to be high-internals.[6] A strongly internal locus of control orientation should drive active selection into the mentor role, besides other factors such as prosociality (Kosse et al., 2020). Additionally, mentors may be hypothesized to hold high self-efficacy expectations, in the sense that they can help others in unraveling their full potential. Information collected from mentors allows to test this assumption that mentors hold strongly internal (low external) locus of control orientations. Thus the auxiliary hypothesis is:

`AH1`: *Mentors have a high internal (low external) locus of control orientation.*

As mentioned above, mentoring is hypothesized to affect mentees' locus of control through all sources of social learning: verbal persuasion, own experiences and vicarious experiences.

[4]Mentors are likely to hold a socio-economic status that is, on average, higher than their mentees' socio-economic statuses. This alone may be a reason for their locus of control to be on average more internal (less external) than the locus of control of their mentees. Peer-to-peer mentoring relations are an exception.

[5]In informal mentoring relationships that are not explicit, the mentor may be selected by the mentee, potentially even without being aware of this role. When the mentoring relationship is not entered consciously on the side of the mentor, the case for a strong internal locus of control orientation on the side of the mentor is not as strong.

[6]There are contexts in which the mentoring relationship is institutionalized, explicit and voluntary but not entirely intrinsically motivated. This may, for example, be the case in institutionalized mentoring dyads at the workplace. In this case, the motivation may be somewhat more external.

Mentors may affect mentees' locus of control orientations through *verbal persuasion.* As part of the mentoring relationship, mentors may repeatedly and in varying situations, point out to their protégé that what happens to them is a result of their own behaviors and choices. Mentors may explicate their own internal locus of control beliefs to mentees, in appropriate situations. Moreover, mentors may help their mentees understand how a particular behavior led to a certain consequence. Relevant situations in mid-childhood might be disagreements with parents or siblings, and problems with friends, school-mates or class teachers, or low school-performance. In going through how alternative behaviors may have led to alternative outcomes, mentors may help children understand the association between their actions and obtained results.

Mentoring may affect an individual's locus of control by *creating experiences of contingency.* Mentors may support mentees in creating experiences of conditionality by encouraging them to undertake actions or make decisions that may have been avoided or not made otherwise. It is assumed that mentors will try to assist the mentee in identifying desirable outcomes as well as potential strategies to realize these outcomes. Additionally, mentors may potentially provide support in executing these strategies. When the desired outcome is obtained after executing an identified strategy, the mentee will have learned that outcomes are conditional on individual choices and behaviors. In the context of mid-childhood, mentors may, for example, encourage mentees to study for school and support them in their studies. If the child gets a good grade, the child can make an experience of conditionality. Similarly, the mentor may help the child find ways to resolve regularly recurring problems with a sibling or a classmate in a way that the the outcome desired by the child is obtained. If the mentor succeeds in creating many of these experiences of conditionality, the child may become more internal over time.

Finally, mentees may adopt a more internal locus of control through *vicarious experience.* That is, by observing how the mentor's choices and behaviors affect outcomes in the mentor's life. Vicarious experiences are particularly relevant in situations for which own experiences are not available (Bandura, 1977a). Of course, vicarious learning may depend on mentor's reports of his choices and behaviors and the resulting outcomes because the mentee cannot observe the mentor in all cases. In the case of children, relevant examples might be, observing how the mentor interacts in social situations, such as politely asking another person for a favor, and obtains the desired outcome.

These learning processes may be particularly relevant for children from low-SES contexts because there may be fewer learning opportunities in the family context (compared to high-SES contexts). Due to the factors laid out in Chapter 5 children from low-SES households may, in contrast, be more at risk of developing external locus of control orientations through vicarious learning and verbal persuasion as a consequence of the higher degree of external control and powerlessness experienced by their parents and through own experiences of powerlessness that may result from subsequently increased family-stress.

> `H2`: *Mentoring increases internal (decreases external) locus of control orientation in children from low-SES households.*

Of course mentoring may increase internal (decrease external) locus of control orientations in general. Since mentoring was only provided to low-SES children in the study that underlies this chapter, this more general hypothesis can, however, not be tested.

Children with lower initial internal locus of control orientations may also profit more from mentoring than children who are already more internal at the outset. There is simply more room for change for these children. Hence, the third hypothesis to be tested is:

> `H3`: *Children with a lower initial internal locus of control profit more from mentoring than children with a higher initial internal locus of control.*

The final hypothesis to be tested is whether mentoring also moderates the direct effect of the home-environment on locus of control. Mentoring may indirectly affect locus of control by moderating the influence of the parental home on locus of control in addition to the direct influence via the channels described above. In the presence of an extrafamilial source of support and learning, the family environment may become less critical in the formation of children's locus of control.

> `H4`: *Mentoring has an additional indirect effect on locus of control by (negatively) moderating the effect of the parental home on locus of control.*

8.3 Evidence from previous research

Empirical evidence on the effects of mentoring on locus of control orientation is somewhat limited. Of those studies that exist, each study is based on a particular mentoring program designed for a specific context. Therefore, results cannot easily be compared or generalized. The existing intervention studies that studied effects on generalized locus of control yielded mixed results. While some studies found that locus of control of at-risk-groups was susceptible to intervention in pre-school age (Walden and Ramey, 1983), middle childhood (Rosenbaum et al., 1991), adolescence (Nunn, 1995) and early adulthood (Dua, 1970), others found no significant changes in locus of control or its dimensions (Fertman and Chubb, 1992; Somers et al., 2016). Many intervention studies that could show significant effects on locus of control involved high-intensity interventions delivered by trained professionals.

For pre-school children from low-SES families Walden and Ramey (1983) could show that a high-intensity intervention program, that started at three months and lasted for five years and comprised a day-care program for 8 hours per day, five days per week, 50 weeks per year, had significant effects on children's generalized and academic locus of control. The program was designed to meet each child's educational needs, and abilities and [t]he "environment was structured to emphasize positive experiences (e.g., the rewards of success) and to instill a sense of mastery and competence in each child" (Walden and Ramey, 1983, p. 350). The 18 low-SES children who had participated in the intervention had more internal *academic* locus of control than the 14 children in the low-SES control group. For *general* locus of control, the low-SES non-intervention group had, on average, the highest internal . Treated children's internality was comparable to the internal control orientation held by the high-SES control group.

Rosenbaum et al. (1991) studied an intervention that targeted 22 nine-year-old girls and focused on emotional and practical problem-solving. The program was delivered by teachers who were certified rational-emotive-therapy trainers [7] as part of the fourth-grade curriculum one hour a week for 14 consecutive weeks. The goal of the program was to teach the girls to approach problems in a constructive manner by defining the problem, finding alternative solutions and means and methods for goal attainment. The girls learned to identify and evaluate their own emotions and trained strategies to solve emotional problems

[7] The program was based on the concepts of rational-emotive education and rational emotive group counseling' (Bernard and Joyce, 1984).

effectively. They also were encouraged to accept problems as a normal element of life, and they were encouraged to approach peers for help before approaching parents or teachers. Fourteen fourth-graders from another class at the same school who did not receive the training served as a control group. While there were no differences in locus of control orientation as measured by CNS-IE between the intervention and the control group before the intervention, girls who had received the training were significantly less external after the training and they were significantly less external than the girls in the control group (Rosenbaum et al., 1991). In contrast to many other studies, this study did not target an at-risk group.

A study by Nunn (1995) indicates that a one-year training of learning styles and strategies that consisted of one school-class every other day and was delivered by experienced middle-school teachers could significantly reduce external locus of control as measured by the CNS-IE scale in treated as compared to non-treated seventh and eighth-graders with problematic school performance.

Somers et al. (2016), in contrast, could not find significant changes in a measure related to locus of control for a combined high-intensity tutoring-mentoring intervention that targeted adolescents at risk of high-school dropout. In this intervention, at-risk adolescents were paired with a tutor-mentor from a local university. Tutor-mentors met with their protégés four afternoons a week for one year to help with school-exercises but also to provide personal support that was not school-related.[8] Although changes in personal control belief could be observed in treated adolescents, the difference between pre- and post-test was not significant.

In another intervention study that targeted female first-year university students with increased social anxiety, Dua (1970, p. 568) could show that external locus of control could be reduced significantly by an 8-week action-oriented training program, that was designed "to help the subject individually to establish specific action programs that would move them toward creating new but specific behaviors designed to improve the relationship with a 'significant other' ".

While many of the studies above evaluated intervention programs that involve some

[8]The authors used the Belief in Personal Control Scale (Berrenberg, 1987, cited in Somers, 2016). "The scale measures three dimensions of personal control: general external control, exaggerated internal control, and God-mediated control. The general external control measures the extent to which one believes the outcomes in his or her life are produced by his or her own actions or by fate or others" (Somers et al., 2016, p.204).

direct modification of habitual ways of thinking or dealing with problems through explicit training, there are also studies that indicate that purely experience-based programs can affect locus of control orientations. Hans (2000), for example, reviewed 22 intervention programs that involved activities in the outdoors such as rope-garden exercises or wilderness exposures. Such experience-based interventions also had a significant effect on locus of control. Another example of experience-based influence on locus of control is a study by Gottschalk (2005) who could show that participation in an earnings-subsidy program that aimed to move single-parents out of social assistance and into paid employment had a significant effect on locus of control.

In addition to these studies on generalized locus of control orientations, a large number of intervention studies demonstrated the susceptibility of domain-specific locus of control orientations to intervention. Moreland et al. (2016), for example, found that an 8-week parenting program successfully improved parental locus of control. Several studies could show that health-locus of control could be moved towards the internal dimension, and chance orientation could be reduced through education and training programs focusing on specific health issues (Field and Kruger, 2008; Moshki et al., 2014). Other examples for domain-specific locus of control orientations that could successfully be modified through experience-based interventions include cognitive locus of control (Wolinsky et al., 2010) and driving locus of control (Huang and Ford, 2012).

In sum, the evidence suggests that both, general and domain-specific locus of control orientations are susceptible to change through explicit training and, more indirectly, through experience-based interventions. It should be noted that none of the studies above followed participants long-term such that it is unclear how lasting the effects on locus of control are. Moreover, many of the studies are based on very small samples, with treatment groups of 10 - 22 individuals (Dua, 1970; Rosenbaum et al., 1991). Moreover, many of the studies targeted particular populations, such as low-SES children, children with problematic academic records, socially anxious females, or individuals with specific health problems. It is thus important to test lasting effects in larger populations and to assess whether individuals who are not at-risk or disadvantaged in some sense also benefit from intervention programs.

A central assumption of the theoretical arguments above is that mentors have a strongly internal locus of control. Empirical evidence regarding this hypothesis is scant. In one study on mentoring in the professional context, Allen et al. (1997) provided evidence that individuals with a more internal locus of control were more willing to become a mentor for others.

Regarding the third hypothesis that concerns differential treatment effects based on initial locus of control, the evidence is mixed. Turban and Dougherty (1994) showed that individuals with more internal locus of control orientations were more likely to seek out a mentoring relationship in a professional setting. On the other hand, the study by Rosenenbaum (1991) revealed that the most remarkable changes were observed for those with the initially most external control beliefs.

As far as the evidence regarding the fourth hypothesis is concerned, there is some evidence indicating that extra-familial support systems supplement the parent-child relationship (Rhodes, 1994). A considerable part of the literature, however, favors a compensatory relationship (Rhodes, 1994). The protective function of the extra-familial relationships has been positively associated with the degree of empathy, authenticity, identification, and companionship between the child and the external source of support (Spencer, 2006).

8.4 Data and Measurement

The empirical analyses in this chapter are based on data from the briq Family Panel, which contained a one-year low-intensity mentoring intervention. In this section, the design of the briq Family Panel and the mentoring intervention will be described. In addition, this section will also introduce the locus of control measures which were used in this study. For a more comprehensive description of the recruitment process and randomization strategy, the reader is referred to Kosse et al. (2020).

8.4.1 The briq Family Panel

The briq Family Panel is a panel of children and their families who lived in the Germany cities of Bonn or Cologne and were 7 to 9 years at panel start in 2011. The participating families where sampled from registry data. In 2011 invitations to take part in the study were sent to all families with children born between September 2003 and August 2004 and one-third of the families with children born between September 2002 and August 2003 (Kosse et al., 2020).[9] The invitation letters contained information about the possibility to take part in a mentoring program, which would, however, not be available to all participants due to capacity constraints. With this initial invitation families were asked to provide some information on the socio-economic characteristics of the household together with a non-binding letter of intent to participate in the study and the mentoring program. Based on the information from the 1,626 valid returned questionnaires, households were categorized as having high or low socio-economic status. All families in the low-SES category were invited to participate in the study. To be eligible for the mentoring program, these families had to participate in the first round of face-to-face interviews (henceforth, baseline or wave 1) and they had to consent to the transmission of their addresses to the organization running the mentoring program. Face-to-face interviews were conducted in apartments that had been rented for this purpose in a central location in Bonn and Cologne. Parents who accompanied the children were also interviewed. In 95 percent of all cases, the interviewed parent was the child's mother. The accompanying parent provided extensive information about the child and joint activities, but also on own attitudes and preferences, as well as the family's socio-economic situation.

After this process, 590 low-SES families that were eligible for treatment remained. These were randomly attributed to a treatment (212) and a control group (378) using stratified random assignment to guarantee a proportional representation of the criteria for low socio-economic status in both cities.[10] The local availability of mentors had to be considered as well. After randomization, the addresses of selected families were handed to the mentoring organization, which then initiated the treatment. A second control group of 150 families classified as high-SES were also invited to take part in the study. 122 of these high-SES families took part in the baseline. Hence, the full baseline sample consisted of 712 families.

Children in treatment group received low-intensity mentoring from a volunteer for one year. After the treatment period, all families who had participated at baseline were invited for a second round of face-to-face interviews (wave 2). 607 out of the 712 (85.3%) participated in the second wave. After the second wave of face-to-face interviews conducted at the

[9] This meant that children in the younger cohort were in second grade.

[10] Stratification considered 14 subgroups resulting from the combination of city (Bonn or Cologne) and SES criteria (low income and/or low education and/or single-parent status) (Kosse et al., 2020, p. 441).

centrally located appartments, the briq Family Panel was integrated into the Innovation Sample of the Socio-Economic Panel Study (SOEP-IS). This meant, that from the second year onwards, the participating families were visited at their homes by trained interviewers.[11] In all waves, interviews took about one hour. Mothers received between 35 € and 45 € for the interviews in the different years. Children were also interviewed themselves and could gain little prizes for their participation in simple behavioral experiments.

8.4.1.1 Description of the mentoring intervention

The mentoring-intervention was conducted by Baloo and You, an established non-governmental organization that pairs volunteers with elementary school children for one year. The mentoring organization does not have a particular programmatic focus. It does not prescribe the activities undertaken with the mentees, but instead invites a free development of the mentoring relationship, which allows both parties to tailor the interaction according to their own preferences. The programmatic liberty provided by Baloo and You is hypothesized to facilitate the emergence of genuine primary bonds necessary for successful relationship-building, rather than secondary bonds which are typically more limited, emotionally-distant supportive involvement with a focus on a particular task, such as doing homework together (Freedman, 1988). To this end, mentors are encouraged to approach their protégés as 'benevolent friends'. The idea is that the development of a strong, personal relationship between the children and their mentors will foster informal learning in everyday situations. The program's goal is to enhance children's skills and knowledge by enriching their social-environment through an extra-familial adult that is interested in their development and acts as a role model. Mentors typically spend one afternoon a week with their protégés, engaging them in joint activities tailored to the mentee's (but also mentor's) needs and interests. Examples for these joint activities are visits to the zoo, a museum, the playground, doing handicrafts, or simply having a chat.

Mentors are mostly university students aged between 18 and 30. They were embedded in a rich support network organized by the organization, which also included support from trained professionals. Mentors report their activities and potential challenges to the mentoring organization and receive guidance and feedback from trained educators or psychol-

[11] Switching to face-to-face interviews being conducted at the homes of the study participants greatly increased the response rate.

ogists weekly via an online-diary. Moreover, the mentors receive guidance and suggestions for activities in bi-weekly face-to-face meetings with representatives from the organization and other mentors.

Successful mentor-mentee matches were found for 74% of the children in the intention to treat (ITT) group.[12] Treated children met on average 22.8 times (11.9 SD) with their mentor for an entire afternoon. The total treatment time thus amounts to roughly 92 hours per child. The average duration of the mentoring relationship was 9.3 months (Kosse, 2020). The shorter duration was mainly due to unforeseeable events such as job-changes of mentors, or children or mentors moving away.

8.4.2 Operationalization and measurement of core concepts and variables

This section describes the operationalization and measurement of the concepts that are relevant for research question addressed in this chapter.

Parental socio-economic status

To qualify for treatment, children had to be categorized as coming from a low-SES household. A household was classified as low-SES if at least one of the following criteria applied (Kosse et al., 2020):

1. low household income: equivalence weighted household income of less than 1,065 € ($\approx 30^{st}$ percentile)

2. low parental education: neither of the parents has a school leaving certificate that qualifies for entry into tertiary education

3. single parent: the child is growing up with a single parent (i.e., parent is not living together with a partner)

Households for which none of the aforementioned criteria applied, were classified as high-SES. Hence in high-SES households, at least one of the two parents had a school leaving degree that qualified for entering tertiary education and the household had more

[12]For 26 percent of the children matches could not be realized because of a local shortage of mentors, mentor refusals, or coordination problems between mentors and families (e.g., pregnancy of the mentor, moving of mentor or family, etc.). Most of these children were never contacted by the organization (Kosse, 2020 p. 448).

euqivalized household income than the poorest 30 percent of the German population. Fulfilling these criteria, the household is likely to enjoy at least a middle-class SES, or higher.

Locus of control

Children's locus of control is measured in all waves of the briq Family Panel. Mentors' locus of control was measured between wave 1 and wave 2. Parental locus of control was measured in waves 1, 2 and 6. The measurement instrument for children's locus of control was changed after wave 3 and then again for waves 6 and 7. In wave 6 the measurement instrument for children corresponds to the measurement instrument used for mentors and parents. Table 8.1 provides an overview over the respective measurement scales for children, their parents and mentors in the respective waves. A more detailed overview, that includes the individual items for each of these scales is provided in the Appendix C in Table C.1. Summary statistics for the individual items are presented in Table C.2 in Appendix C.

Table 8.1: Instruments used to measure locus of control in the briq Family Panel

wave	**child**	**parent**	**mentor**
1	Subset of CNS-IE	*IPC Short Scale*	*IPC Short Scale*
2	Subset of CNS-IE	*IPC Short Scale*	
3	Subset of CNS-IE		
4	Mixed Scale		
5	Mixed Scale		
6	*IPC Short Scale*	*IPC Short Scale*	
7	IE-4 Scale		
8	IE-4 Scale		

Note: The table provides an overview over the different survey instruments that were used to measure locus of control children, the accompanying parent and mentors in the briq Family Panel. In waves 1, 2 and 3 children's locus of control was measured with a subset of 5 items from the Children's' Nowicki-Strickland Internal-External Scale (CNS-IE) by Nowicki & Strickland (1973). In waves 4 and 5 a mixed scale of three items recruited from the CNS-IE Scale, the IPC Short Scale and the Grit Scale is used to approximate children's locus of control. The German IPC Short Scale developed by Krampen (1981) is used to measures children's' locus of control in wave 6 and parents locus of control in waves 1 2 and 6 and mentors' locus of control. In waves 7 and 8 children's locus of control was measured with a subset of the IE-4 Scale by Kovaleva (2014).
Source: Own illustration based on briq Family Panel waves 1-8.

These frequent changes can partly be attributed to the aim of measuring locus of control orientation in accordance with the developmental stage of the child. Between 7 and 17, which is the age range covered in the eight waves of the study, children's cognitive capacities and their ability to reflect on abstract concepts such as locus of control are likely to change. Therefore, changes in the survey instrument that measures locus of control help achieve a better or more efficient measurement of the construct. However, changes in the measurement instruments prevent comparison across time. As a consequence, the development of locus of control cannot be traced without making strong assumptions about the convergent reliability of the different scales. In the following, each of the utilized measurement instruments is introduced in more detail.

In the first three waves, locus of control was measured with five items from the CNS-IE questionnaire. The selected items showed high correlations with the overall scale in the original sample and cover the internal and the powerful others external dimension. The chance dimension is not covered by the included items.[13] Internal consistency of the selected items is consistently very low in the sample of the briq Family Panel, ranging between 0.19 and 0.28. This suggests that the selected items do not measure a single construct. This is confirmed by factor-analytic examination of the data structure. None of the factors met the Kaiser Kriterion of an Eigenvalue > 1. The corresponding Scree-Plot, which pools data from the first three waves is depicted in Panel a) of Figure C.1 in Appendix C. The lack of unity in the latent construct may be due to the fact that two out of five items are context-specific with regards to schooling. Due to the low reliability of the measure and its low validity that derives from the partial context specificity no latent score was built for this measure. Instead, the measure was broken into more valid subscales covering an internal scale, a powerful-others scale, and a school-specific locus of control measure. The latter was, however, excluded from further analyses.

In the fourth and fifth wave, locus of control was measured with mixed set of three items that combines two locus of control items taken from the measurements used in wave 1 to 3, and wave 6 with one item that measures the perseverance dimension of Grit. In the following, this scale will be referred to as the 'mixed scale'. One of the locus of control items is domain-specific and refers to academic success, while the other measures the chance-facet of the external dimension of locus of control. The resulting scale had a fairly low internal consistency of 0.3 to 0.4 and uni-dimensional structure was not supported. The corresponding Scree-Plot is depicted in Panel b) of Figure C.1 in Appendix C. Given the insufficient reliability and validity of the measure, no latent score was built. Instead,

[13]The CNS-IE Scale does not foresee a three-dimensional structure, but it nevertheless includes several items referring to chance and fate.

items were included in the further analyses individually.

The locus of control instrument used for children in wave six, for mentors in wave one, and in waves one, two, and six for parents is a subset of a German eight-item locus of control short-scale developed by Krampen (1981). All items are measured on a 7-point Likert Scale. This measure builds upon Levensons' IPC scale, that distinguishes the external dimension into a chance factor and a factor for powerful others.[14] While originally intended as a two-dimensional measure (Krampen, 1981), a subset of seven items of the scale can be used to construct a uni-dimensional measure of internal locus of control, which has higher internal consistency than the original two-dimensional solution (Richter et al., 2017; Specht et al., 2011b). Locus of control for parents and mentors is measured using this seven-item scale. Crohnbach's α for parents is 0.63 and 0.61 for mentors. Crohnbach's α for the sample is thus slightly lower than the one reported for a representative sample of adults in Germany (0.68 - 0.70) for the equivalent item battery (Richter et al., 2017). For children, the scale consists of only six items. The additionally left-out item reads 'Compared to other people, I have not achieved what I deserve'. For children, Cronhbach's alpha for the uni-dimensional scale using six items is 0.57. Scree-plots for parents, mentors, and children indicate a uni-dimensional structure for the used items. The respective scree-plots can be found in panels c), e) and f) in Figure C.1 in Appendix C. For this measure, a latent score indicator for generalized locus of control was constructed, by recoding items such that higher scores indicate more internal locus of control, standardizing the items and then taking an average of the respective six or seven items and standardizing the resulting average again. Figure C.2 in Appendix C plots the distributions of the final locus of control score as compared to a normal distribution. Additionally, individual sets of items representing the internal, powerful others and chance dimension will be used in the empirical part of the chapter.

In waves 7 and 8 locus of control is measured using three out of four items of the IE-4 scale by Kovaleva et al. (2014). In the original four-item measure, internal and external locus of control are measured with 2 items for each dimension on a 5-point Likert Scale. Latent scores are constructed by taking the averages of the relevant items. The left out

[14]The full 8-item instrument is regularly asked in a large representative German panel study (the German Socio-Economic Panel Study, henceforth SOEP), thus allowing comparisons with a representative sample of the adult German population.

item reads 'Whether at work or in my private life: What I do is mainly determined by others'. As a consequence, the dimension of powerful others is not covered in waves seven and eight. Instead, a second item for the chance dimensions was added. This item corresponds to the chance item from the IPC Short Scale (loc_3), which has been part of the survey since wave four. The additional item is, however, asked on a 7-point Likert Scale.

For this purpose of building dimensional measures of locus of control all item batteries were inspected for items that had a high face-validity for one of the dimensions of locus of control that were identified in previous research. In line with the IPC-framework suggested by Levenson (1981) a general internal dimension (I) is differentiated from an external dimension that is further differentiated into determination by powerful others and social conditions (P) and a dimension for pure luck, chance and fate (C).[15] Table C.6 in C indicates which items of the respective scales were used for the dimensional and domain-specific measures of locus of control. Latent scores for the dimensional measures were built by calculating the means across (non-standardized) items as indicated in Table C.1. For the dimensional measures, items were recoded in such a way that higher numbers indicate a greater agreement with the respective dimension.

Intra-class correlations for the individual items for children were investigated for the items that were asked in several waves. The intra-class correlations (reported in Table C.5 in Appendix C) for the high-and low control group range between 0.094 and 0.465. For the first three waves, inter-temporal stability is much lower than for later waves. Considering that Nowicki et al. (2018b) finds a correlation of 0.22 for measures of locus control between age 8 and 16 using the CNS-IE scale, the year on-year correlations found for the CNS-IE sub-scale used in the first three waves, when children are 7-11 are very low. Richter et al. (2017) finds a retest correlation of 0.45 for the Chance item (loc_3) after 30-49 days for adults. For adults, Kovaleva et al. (2014) finds a test-retest correlation of 0.6 for both dimensions of the IE-4 Scale after 6 to 10 weeks. Considering that locus of control changes substantially in young age, and that the children are aged 14-17 in waves 4 and 5, the 0.4 year-on-year correlation for the Chance item and the IE-4 Scale items seem to be within a reasonable range.

[15]In addition to that, a domain-specific measure is constructed from the schooling-related items in the measurement construct for the first five waves. Results for this domain-specific control beliefs are discussed in Figure C.3 Appendix C.

8.5 Results

8.5.1 Auxiliary Hypothesis: Mentors locus of control orientation

This section tests the auxiliary assumption on mentors' locus of control orientation. For this purpose, mentors' locus of control is compared to mentees' and parents' locus of control orientation for generalized locus of control and its dimensions. Figure 8.1 and Figure 8.2 show group differences in general and dimensional locus of control respectively. A corresponding table can be found in Appendix C.7.

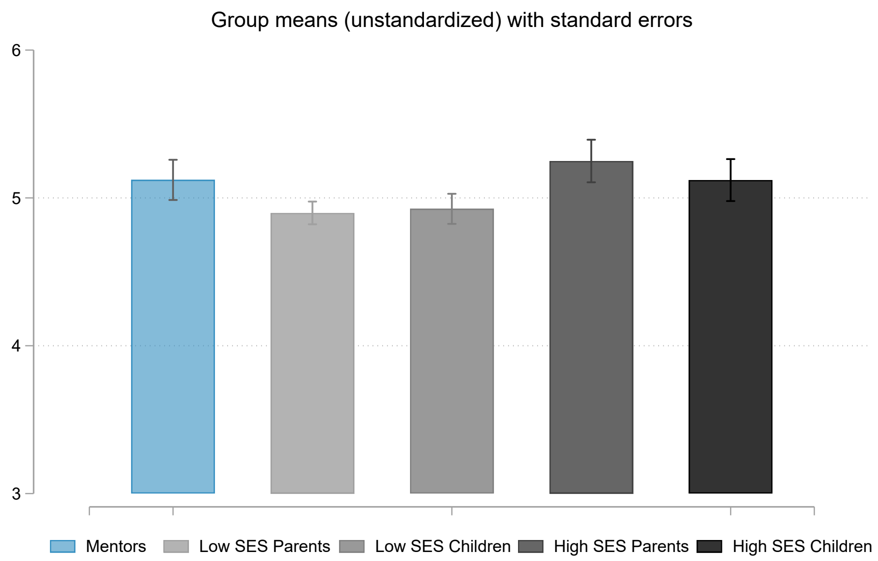
The descriptive results indicate that mentors hold more internal (less external) generalized locus of control beliefs than low-SES parents and low-SES children. The difference is about one-quarter of a standard deviation. A two-group t-test assuming unequal variances between groups reveals that the difference between mentors and low-SES parents is significant (t-statistic: -2.8345; df: 169).[16] The small difference in locus of control between mentors and high-SES parents is not significant (t-statistic: 1.278; df: 216). Mentors are also about one-quarter of a standard deviations more internal than the children in the low-SES control group, and this difference is also significant (t-statistic: -2.2832, df: 212).

A closer look at the dimensional measures of locus of control reveals that the observed group differences in general locus of control are not due to differences in the internal dimension. Contrary to the expectations, mentors' internal locus of control does not differ significantly from the internal locus of control orientation of low or high-SES children and their parents. The internal dimension of locus of control is even more eminent - although non-significantly - among low-SES parents and their children than among mentors and high-SES parents and children. Similarly, there are no significant group differences in the external dimension of 'powerful others' in the sample.

Chance is the only dimension of locus of control where clear differences exist. Compared to high and low-SES parents and their children, Mentors believe least that "what a person achieves in life is above all a question of luck and fate". On average, the chance orientation of children from the low-SES control group was about 0.41 SDs higher than that of the mentors, that of low-SES parents about 0.38 SDs. Both group differences are highly significant (t-statistic: 3.472, df: 182 for low-SES children, and t-statstic 4.966; df:

[16]The same is true for a t-test that compares mentors only to the low-SES parents of children selected for treatment: (t-statistic: 2.123; df: 240).

Figure 8.1: Group means in locus of control orientation for mentors, parents and children



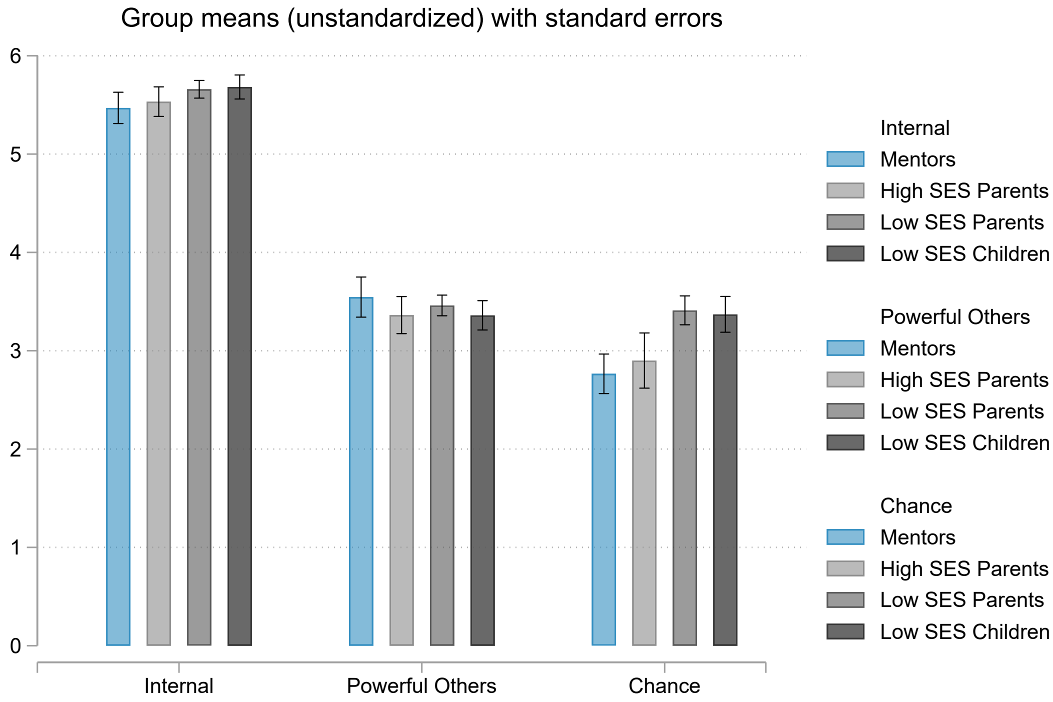
Note: The figure shows group-means of locus of control for general locus of control for mentors, high and low-SES parents and low-SES children from the control group. Parents' and mentors' dimensional locus of orientations were obtained in wave 1. Children's dimensional measures of locus of control were obtained in wave 6.
Source: Own illustration based on briq Family Panel waves 1 and 6.

283 for low-SES parents). The difference between mentors' chance orientation and that of high-SES parents is not significant (t-statistic: 0.773; df 205).

The auxiliary hypothesis that *'mentors have a high internal (low external) locus of control orientation'* could be partly rejected. Mentors' internal locus of control orientation does not differ from that of any other group. However, mentors have a particularly low external locus of control orientation due to their lack of belief in chance and luck as determinants of life-outcomes. In this dimension, mentors are very similar to high-SES parents but dissimilar from low-SES parents and the children in the low-SES control group.

Changes in locus of control that result from vicarious learning and persuasion are expected in the 'Chance' dimension of locus of control, as this is the only dimension in which mentors are significantly different from the treated children and their parents. Experiential learning may, however, lead to changes in the other dimensions of locus of control. Additionally, mentors themselves might change their locus of control orientation through experiences made in the mentoring relationship. Unfortunately, such reverse effects cannot be tested as there is only one measurement of mentors' locus of control.

Figure 8.2: Group means for mentors, parents and children for each dimension of locus of control



Note: The figure shows group-means of locus of control for each dimension of locus of control for mentors, high and low-SES parents and children form the low-SES control group. Parents' and mentors' dimensional locus of orientations were obtained in wave 1. Children's dimensional measures of locus of control were obtained in wave 6.
Source: Own illustration based on briq Family Panel waves 1 and 6.

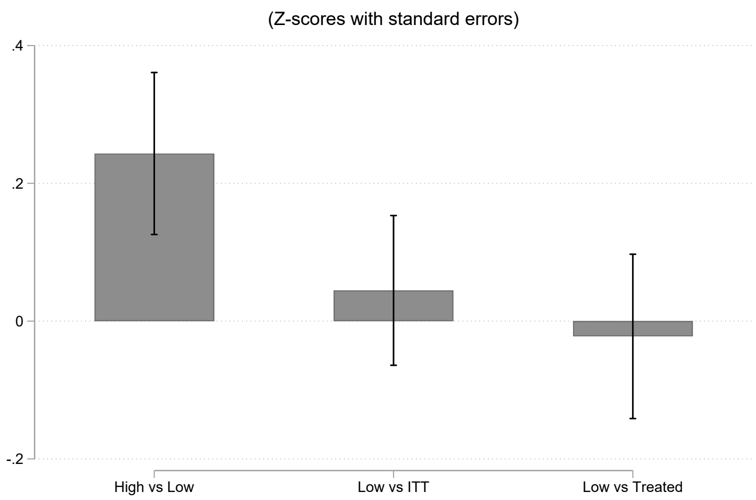
8.5.2 Results for generalized locus of control

8.5.2.1 Social Gradient and effectiveness of the intervention

This section investigates the main hypotheses for generalized locus of control. Measures of generalized locus of control are taken from wave six for children and wave one for parents and mentors. Figure 8.3 shows the results of t-tests comparing group means in the latent scores for generalized locus of control for different pairs of groups. The bar on the left compares children from the high-SES control group with children from the low-SES control group. The significant t-statistic (t-statistic: 2.069; df: 333) indicates that children in the high-SES control group hold, on average, a more internal generalized locus of control orientation than children in the low-SES control group. Thus, the evidence corroborates the first hypothesis that children in low-SES contexts hold a less internal (more external) locus of control than children in more privileged contexts. This finding is in line with previous research (Cobb-Clark et al., 2019; Golding et al., 2017; Ng-Knight and Schoon, 2017b; Stephens and Delys, 1973).

The second and third bar provide initial evidence regarding the main research question of this chapter. The second bar shows differences in generalized locus of control in the sixths wave between the group selected for treatment (intention to treat: ITT) and the low-SES control group. The third bar shows differences between actually treated children and the low-SES control group. In both cases, the t-tests did not yield significant group differences. Hence, the evidence suggests that five years after the treatment, treated children were not different from non-treated children with regards to generalized locus of control.

Figure 8.3: T-Tests between different sets of relevant groups for generalized locus of control



Note: The figure shows mean differences between key groups in generalized locus of control. Results were obtained from two-group ttests. Measures for children were obtained in wave 6. Error bars not crossing the 0 line indicate that the difference in means between groups is significant.
Source: Own illustration based on briq Family Panel wave 6.

While it may be the case that the intervention program dot not affect generalized locus of control, it could also be that the effect of the treatment has leveled off after five years. Before rejecting the hypothesis that mentoring affects low-SES children's locus of control, the information on locus of control available for the other waves should be scrutinized, even if no latent scores for generalized locus of control can be built for these waves. For this purpose, the dimensional measures of locus of control as indicated in Table C.1 were utilized in further analyses.

8.5.3 Evidence for dimensional measures of locus of control

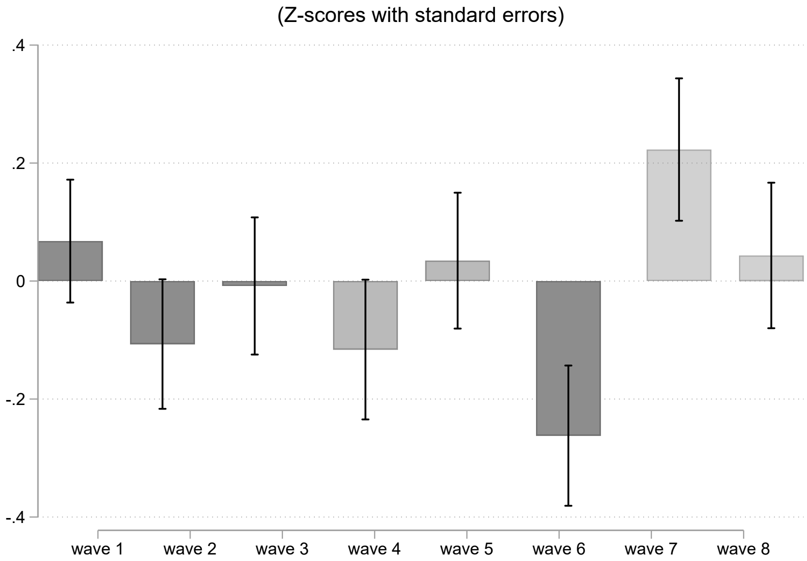
8.5.3.1 Social Gradient in different dimensions of locus of control

Two-group t-tests were performed to determine whether there are significant mean-level differences between children from high and low-SES control groups in the different dimensions of locus of control. The results are reported in Figures 8.4 to 8.6. The figures display the respective 'gaps' between high-SES children and low-SES children for the individual dimensions of locus of control for the respective waves.

No clear social gradient can be determined for the internal dimension of locus of control - at least not for the different measures used across the panel. In six out of eight waves, children from the low-SES control group did not differ significantly in their internal locus of control orientation from children from the high-SES control group. In wave six, children in the high-SES control group were significantly less internal in their locus of control orientations than children from the low-SES control group. In wave 7, it is the other way round. Some of the observed fluctuations may be due to different items underlying the dimensional measures in different waves. However, fluctuations are also observed for those waves in which the measure of internality is based upon the same set of items. These within-measurement fluctuations may indicate substantial measurement error. Considering the low retest validity observed for many of the items when the children are younger, the within measurement fluctuations in waves one to three and four and five are less surprising.

For the two subscales of the external dimension, the results are more robust across waves and measurement instruments. The two-group t-tests indicate that children from the high-SES control group consistently hold less external locus of control orientations than their peers from low-SES families. This holds for both of the external dimensions. For the Powerful Others dimension, the difference in group-means is only significant at baseline and in wave three (Figure 8.5). For the other two years, high-SES children report feeling less determined b by powerful others than low-SES children, but the difference is not significant. For the Chance dimension (Figure 8.6), which is consistently measured with the same item from the fourth to the eighth wave, the mean difference between children from the high and low control group is significant in all waves. Children from high-SES households feel, on average, less determined by luck and fate than the children in the low-SES control group.

Figure 8.4: High to low-SES gaps in the internal dimension of locus of control



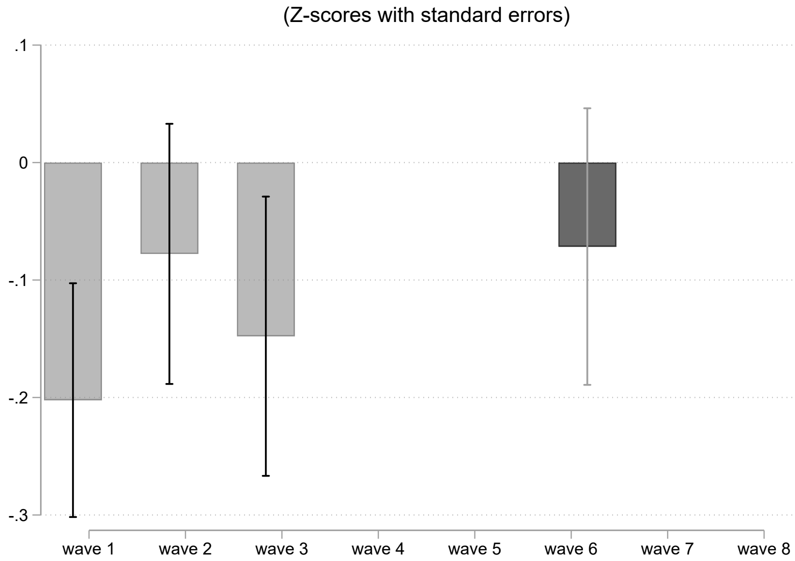
Note: The figure shows mean differences between the high-SES control group and the low-SES control group in the internal dimension of the locus of control orientation for all waves of the panel. Results were obtained from two-group t-tests. Positive values indicate that the mean of the high-SES control group is larger than the mean of the low-SES control group. Negative values indicate that the mean of the low-SES control group exceeds that of the high-SES control group. Error bars not crossing the 0 line indicate that the difference in means is significant. Bars in the same color indicate that the same set of items was used for the dimensional measure of locus of control. The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own illustration based on briq Family Panel waves 1 - 8.

Regarding the first hypothesis, the evidence suggests that while there is no social gradient with regards to the internal dimension of locus of control, children from low-SES contexts hold more external locus of control orientations. In particular, children classified as low-SES perceived life to be more determined by luck and fate than the more privileged children. The first hypothesis is therefore partly rejected and restricted to the external dimension of locus of control.

8.5.3.2 Effects of the mentoring program on different dimensions of locus of control

This section addresses the main research question of this chapter. Did the mentoring program change locus of control orientations in the treated children? Note that all of the

Figure 8.5: High to low-SES gaps in the powerful others dimension of locus of control

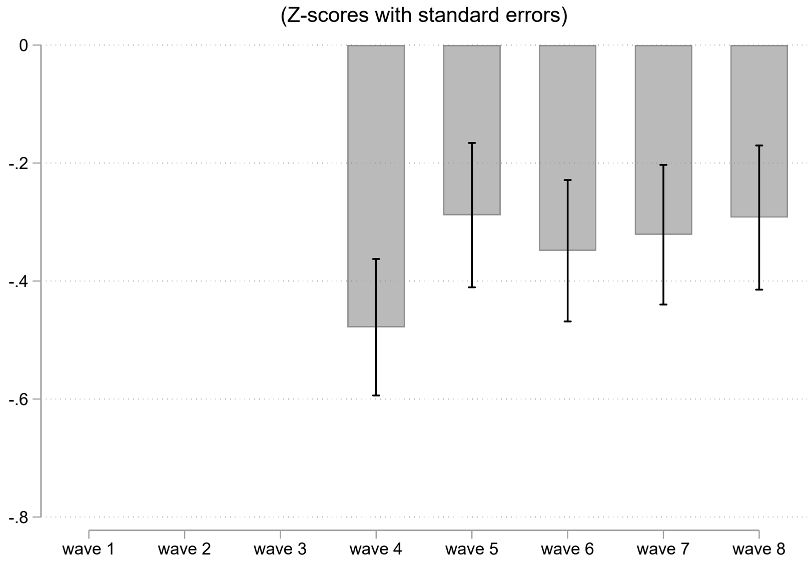


Note: The figure shows mean differences between the high-SES control group and the low-SES control group in the powerful others dimension of the locus of control orientation for all waves of the panel. Results were obtained from two-group t-tests. Positive values indicate that the mean of the high-SES control group is larger than the mean of the low-SES control group. Negative values indicate that the mean of the low-SES control group exceeds that of the high-SES control group. Error bars not crossing the 0 line indicate that the difference in means is significant. Bars in the same color indicate that the same set of items was used for the dimensional measure of locus of control. The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own illustration based on briq Family Panel waves 1 - 8.

following effects are based on the children selected for treatment (intention to treat (ITT) effects). Because not all of the children selected for treatment took part in the mentoring program, estimated effects are likely to suffer from a downward bias. This downward bias is, however, preferred over the potential bias resulting from self-selection when only those children that actually participated in the treatment were included. This is because the size and direction of the bias from self-selection is unknown. If significant treatment effects were found for the ITT group, the same result would obtain in the absence of the downward bias. Therefore estimating ITT effects is considered the conservative strategy.

As a first step, a one-way analysis of variance Analysis of variance (ANOVA) was conducted to see whether there were any significant differences between groups. Bonferroni adjustments were used to address the problem that multiple comparisons of means increase

Figure 8.6: High to low-SES gaps in the chance dimension of locus of control



Note: The figure shows mean differences between the high-SES control group and the low-SES control group in the chance dimension of the locus of control orientation for all waves of the panel. Results were obtained from two-group t-tests. Positive values indicate that the mean of the high-SES control group is larger than the mean of the low-SES control group. Negative values indicate that the mean of the low-SES control group exceeds that of the high-SES control group. Error bars not crossing the 0 line indicate that the difference in means is significant. Bars in the same color indicate that the same set of items was used for the dimensional measure of locus of control. The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own illustration based on briq Family Panel waves 1 - 8.

the risk of a type I error - i.e. identifying a significant difference where there is none.[17] Table 8.2 shows the results of the ANOVA for each locus of control dimension.

For the Internal dimension differences between groups were only significant in wave 6; for Powerful Others, some significant group differences were detected in the baseline. For Chance significant differences between the three groups were identified in all waves. ANOVA only indicates whether there are significant differences between any of the groups. Post-hoc pairwise comparisons between groups using the Tukey HSD test were conducted to see whether treated children differed from the non-treated children in the low-SES control group. The results of the post-hoc comparisons are reported in Table C.8 in the Appendix.[18] The group-difference between treated and non-treated low-SES children is

[17]This is why ANOVA was chosen over multiple t-tests.
[18]Results for post-hoc analyses are reported for all waves, even if the ANOVA was not significant. This

reported in the left panel for each dimension (L vs. T).[19] For the Internal and the powerful others dimension, the mentoring intervention did not have any significant effects on the locus of control orientation of the treated children. The small variation that is observed between groups is not only not significant, but also not systematic in the sense that the means of the treated group are sometimes higher, and sometimes lower than the means of the non-treated low-SES control group. Note that this not only holds between the different measures that have been used but also for years in which the same items were used. In line with expectations, significant treatment effects were found for the chance dimension.

Table 8.2: Results for the Analyses of Variance

	Internal			**Powerful Others**			**Chance**		
Wave	df	F	p-value	df	F	p-value	df	F	p-value
1	2 , 709	0.850	0.430	2 , 708	3.820	**0.023**			
2	2 , 604	1.180	0.307	2 , 604	0.540	0.586			
3	2 , 505	0.080	0.923	2 , 502	1.550	0.214			
4	2 , 501	0.510	0.600				2 , 501	8.780	**0.000**
5	2 , 476	2.040	0.132				2 , 476	3.360	**0.036**
6	2 , 476	2.420	**0.090**	2 , 475	0.330	0.721	2 , 480	5.990	**0.003**
7	2 , 466	1.730	0.179				2 , 472	5.680	**0.004**
8	2 , 453	0.070	0.936				2 , 450	2.850	**0.059**

Note: The table shows the results of the Analysis of Variance for all subdimensions of locus of control in the respective waves of the panel. Significant tests (p-values < 0.1) are indicated in bold-face.
Source: Own calculations based on briq Family Panel waves 1 - 8.

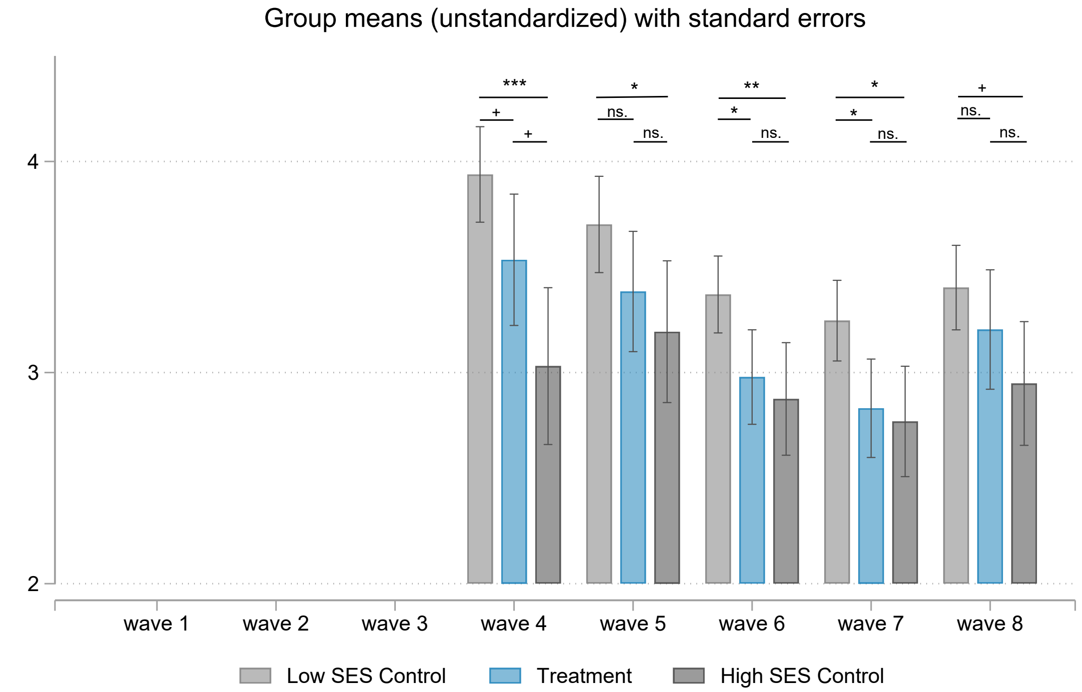
A graphical representation of the results of the post-hoc comparison for the Chance dimension is provided in Figure 8.7. Since no significant treatment effects were found for the Internal and the Powerful others dimension, the respective graphs are in the Appendix. (Figures C.4 and C.5) Treated children had a lower Chance orientation than the non-treated low-SES children in all waves for which a measure of the chance orientation is available. In the fourth, sixth, and sevenths wave, this difference is significant. In waves five to eight, the Chance orientation of treated children was no longer significantly different from the high-SES control group's chance orientation.

This central message also holds when taking clustered sampling into account. Table C.9 in the Appendix shows the ITT effect correcting for clustered sampling from the two cities.

is just done to show, that the small variation that is observed between groups is not only not significant, but also not systematic - in the sense that the means of the treated group are sometimes higher, and sometimes lower than the means of the non-treated low-SES control group.

[19] The implications of the significant ITT effect for the Powerful others dimension will be discussed in detail in the limitations section.

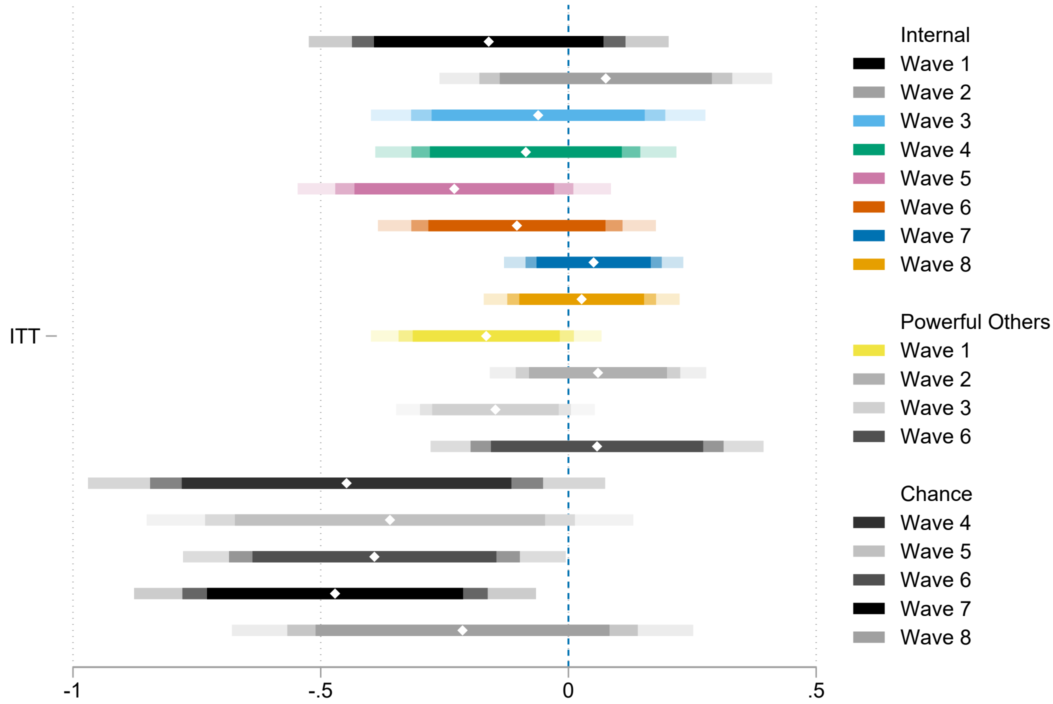
Figure 8.7: Anova for the chance dimension of locus of control



Note: The figure shows mean differences between the treatment group and the low-SES and high-SES control grousp in the chance dimension of the locus of control orientation for all waves of the panel. Results were obtained from Anova tests, using Boneferroni correction for multiple groups and post-hoc tests pairwise group comparisons using Tukey's HSD test. Significance of group differences is indicated above the vertical lines. Significance levels ns. $p > 0.1$; + $p < 0.1$; * $p < 0.05$ **; $p < 0.01$; *** $p < 0.001$; The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own illustration based on briq Family Panel waves 1 - 8.

The respective coefficients comparing children selected for treatment with the low-SES control group across all dimensions and waves are depicted in Figure 8.8. There is a small treatment effect for the internal dimension in Wave 5 (significant the 10 percent level). For all other periods the intervention program did not significantly affect children's Internal locus of control, as compared to the low-SES control group. For the powerful other's dimension, there is a significant treatment effect (again significant at the 10 percent level) in wave 3. Treated children felt less determined by powerful others than their non-treated peers. However, the ITT effects for these two dimensions are not robust. With the direction of the treatment effect changing on a yearly basis, the most reasonable conclusion is that neither the internal nor the powerful others dimension were affected by the mentoring intervention. For the chance dimension, the direction of the treatment effect is more robust: Children in the treatment group felt less determined by chance and fate than the children in the low-SES control group. The difference between groups was significant at the 5 percent level in waves four, six and seven. In the sevenths year after the intervention, however, treated children were no longer significantly different from non-treated children.

Figure 8.8: Intention to treat (ITT) effects for locus of control across time



Note: The figure shows coefficient estimates for the treatment group as compared to the low-SES control group. Coefficient estimates were obtained from ordinary least squares regression, controlling for clustered sampling and applying robust standard errors. Significance levels are depicted in the gradation of the respective colors. The lightest color indicates a significance of $p < 0.01$, the second lightest $p < 0.05$, and the darkest color is $p < 0.10$; A table corresponding to the estimation that underlies this figure can be found in Table C.9 in the Appendix. The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own calculations based on briq Family Panel waves 1 - 8.

In sum, these results indicate that the mentoring program had a relevant effect on the Chance orientation of the treated children, moving them closer to the high-SES control group chance orientation. Although the difference between the treated and non-treated low-SES children is not significant in all waves, the mentoring program is effective in the sense that treated children's Chance orientation was similar to that of high-SES children after the treatment. The mentoring program did, however, not affect the Powerful others and the Internal dimension of locus of control.

8.5.3.3 Differential treatment effects by gender and initial locus of control

This section aims to investigate whether there are differential treatment effects with respect to initial locus of control and gender. Initial locus of control is measured using the one item with high face-validity for a general internal locus of control orientation available at the baseline measurement ("One of the best ways to handle problems is just not to think about them"). All other locus of control items measured at baseline were either context-specific or referred to powerful others. For a more accessible interpretation, initial locus of control was dichotomized at the median for the children categorized as low-SES, such that low-SES children could be categorized as low internals or high internals. Differential treatment effects with regards to initial locus of control were obtained by interacting the dichotomized variable for initial locus of control with the treatment category. The respective results for the Chance dimension can be found in Table 8.3 below.

The results indicated that children who were less internal at the beginning of the intervention did not profit more from the mentoring program than children whose initial internal locus of control orientation was above the median. The same conclusion also holds when initial locus of control is measured as mean of the three non-domain specific items asked in the first wave.[20]

Differential treatments effects by gender are considered since the mentoring program was exclusively implemented by female mentors.[21] In general girls were found to be more internal than boys in the first two waves. In waves three and seven, girls were found to be less internal. Females were not significantly different from males in the two external dimensions of locus of control in this sample. Systematic gender-differences in the effectiveness of treatment could not be found. However, in the sixths the effectiveness of the treatment was significantly different for boys and for girls: Compared to treated boys, treated girls had a significantly higher Chance orientation[22] and a significantly lower Internal orientation[23].

[20] In this case, initial locus of control is measured as a means of one internal and two powerful others items. The items that were used are Frabo_02 (reverse coded) Frabo_03 and Frabo_04. Question wording can be looked up in Table C.1 in the Appendix.

[21] That all mentors were females was by chance, and not by design of the researchers.

[22] The lower effectiveness of the mentoring program for girlswith regards to the chance orientation is consistently observed in all periods, but it is only significant in the sixths wave.

[23] For the internal dimension, the direction of the effect is not consistent across waves. This might be due to the different measures that have been used to measure internal locus of control in the different waves, which were also of varying quality in terms of their validity. The highest quality of measurement for the internal dimension was reached in wave 6, where the significant difference in treatment was observed.

The main effect of treatment was, however, not significant for the internal dimension in wave 6. This means that overall the effect of the program was not strong enough for the treated children to be significantly different from the non-treated children with regards to their internal locus of control orientations, but among the treated children, females were less affected by the treatment than boys. The evidence thus suggests that after five years, the mentoring program, which was delivered by female mentors, had a smaller effect on the treated girls than on treated boys. This is in line with the findings on the cross-gender transmission of locus of control highlighted above.

In sum, the evidence does not support consistent differential treatment effects by initial locus of control. With regards to gender, there is some weak evidence that the program (which was exclusively implemented by females) was slightly more effective for boys than for girls, the difference was however significant.

8.5.3.4 Compensatory or complementary effects

The last question to be addressed is whether the mentoring program has a compensatory effect on the influence of the parental household or whether familial influences are complemented through the mentor's influence. For this purpose, parental locus of control as measured at baseline was interacted with the treatment category to see whether parental influence on children's locus of control orientation differed between the treatment groups. Since the mentoring program only significantly affected the Chance dimension the following analyses were restricted to the Chance dimension. The results for these analyses are displayed in Table 8.4 below.

Parental chance orientation at the beginning of the experiment was positively and significantly associated with children's Chance orientation irrespective of the treatment group (panel a). Gender was included as a control variable, beacuse almost all parental measures are from mothers, and prior analyses have shown that intergenerational associations differ depending on whether same-sex or different-sex pairs are evaluated.

Without the interaction term (panel a) treated children have significantly lower chance orientations than non-treated children in waves six and seven. This main effect turns insignificant once the interaction term between initial parental locus of control and the treatment category is introduced. Including the interaction (panel a), the treatment variable's main effect is significant and negative in waves 4 and 5, again indicating that the children in the treatment group had on average lower chance orientation than the children in the low-SES control group. The interaction effect is non-significant in all waves except for the fourth wave. Contrary to the expectation, the interaction effect is positive, indicating that the association between parental chance orientation and children's chance orientation was stronger in the treated group than in the low-SES control group three years after the intervention. The non-significant main effect of parental Chance orientation means that parental chance-orientation was not associated with children's chance orientation in the low-SES control group. Hence, the mentoring program appears to increase children's sensibility to their parent's chance orientation while at the same time decreasing the children's own chance orientation.

Note that in the sixth to eighth wave, the pattern is in accordance with the expected direction of the effects, namely that positive effect of parental chance orientation on children's chance orientation is less strong for treated children. In these waves, the interaction is however not significant. A non-significant interaction effect hints towards a complementary mechanism rather than a compensatory one. This means that parental Chance orientation and the mentoring intervention have independent effects on the children's Chance orientation and that the mentoring did not alter the influence of parental Chance orientation on their children's Chance orientation.

Table 8.3: Differential treatment effects for Chance by initial LoC and gender

	Wave 4		**Wave 5**		**Wave 6**		**Wave 7**		**Wave 8**	
	(Initial)	(Sex)	(Initial)	((Sex))	(Initial)	(Sex)	(Initial)	((Sex))	(Initial)	(Sex)
Treatment	-0.465	-0.537	-0.553*	-0.507	-0.466*	-0.664**	-0.366	-0.549*	-0.060	-0.273
	(-1.517)	(-1.831)	(-1.970)	(-1.904)	(-2.005)	(-3.268)	(-1.528)	(-2.461)	(-0.204)	(-1.083)
High SES	-1.059**	-1.049***	-0.734*	-0.649*	-0.952***	-0.648**	-0.609*	-0.838***	-0.582*	-0.630*
	(-2.952)	(-3.352)	(-2.293)	(-2.138)	(-3.805)	(-2.757)	(-2.467)	(-3.477)	(-2.000)	(-2.404)
Initial LoC high	-0.252		-0.426		-0.235		-0.001		-0.307	
	(-1.090)		(-1.819)		(-1.260)		(-0.007)		(-1.475)	
Treatment x Initial	0.033		0.343		0.141		-0.183		-0.249	
	(0.082)		(0.919)		(0.470)		(-0.589)		(-0.690)	
Female		0.074		-0.003		-0.084		-0.124		0.156
		(0.320)		(-0.015)		(-0.450)		(-0.637)		(0.767)
Treatment x Female		0.191		0.319		0.580*		0.151		0.141
		(0.494)		(0.861)		(1.988)		(0.500)		(0.398)
Constant	4.229***	4.048***	4.100***	3.860***	3.495***	3.419***	3.448***	3.516***	3.661***	3.407***
	(18.490)	(17.993)	(16.994)	(16.253)	(19.548)	(20.091)	(18.411)	(19.351)	(16.954)	(16.086)
r2	0.039	0.038	0.024	0.019	0.037	0.035	0.031	0.036	0.027	0.022
N	504	504	479	479	483	483	475	475	453	453

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table provides the results for tests of differential treatment effects by initial locus of control and gender. Results were obtained using ordinary least squares estimations with clustered standard errors for the two cities in which the study took place. To gain information on differential treatment effects, the treatment category was interacted with initial locus of control and gender respectivley.

Source: Own calculations based on briq Family Panel waves 1 - 8.

Table 8.4: Complementary or compensatory effects

	Wave 4		Wave 5		Wave 6		Wave 7		Wave 8	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Chance (par)	0.105*	-0.011	0.107*	0.073	0.121**	0.149*	0.087*	0.085	0.099*	0.131*
	(1.972)	(-0.156)	(2.104)	(1.007)	(2.884)	(2.501)	(2.112)	(1.385)	(2.151)	(2.260)
Treatment	-0.376	-1.422***	-0.324	-0.754*	-0.375*	-0.264	-0.447**	-0.238	-0.195	-0.095
	(-1.879)	(-3.428)	(-1.716)	(-1.985)	(-2.512)	(-0.836)	(-2.823)	(-0.725)	(-1.078)	(-0.245)
High SES	-0.823***	-1.146*	-0.468*	-0.316	-0.445**	-0.109	-0.468**	-0.916**	-0.385*	0.065
	(-3.579)	(-2.209)	(-2.202)	(-0.682)	(-2.668)	(-0.288)	(-2.715)	(-2.646)	(-2.071)	(0.166)
Chance (par) x Treatment		0.324**		0.136		-0.033		-0.067		-0.029
		(2.923)		(1.273)		(-0.359)		(-0.737)		(-0.268)
Female	0.131	0.131	0.111	0.119	0.135	0.142	0.036	0.021	0.252	0.260
	(0.786)	(0.794)	(0.698)	(0.745)	(1.067)	(1.121)	(0.272)	(0.162)	(1.722)	(1.773)
Constant	3.636***	4.018***	3.441***	3.536***	2.914***	2.810***	3.131***	3.157***	3.026***	2.906***
	(13.276)	(12.228)	(13.007)	(11.363)	(14.012)	(11.211)	(14.178)	(11.474)	(12.821)	(10.521)
N	497	497	474	474	476	476	468	468	447	447

Note: The table shows results for ordinary least squares regressions that interacts the treatment category with parental locus of control for those in the SES treatment group controlling for the sampling location and applying robust standard errors. *t* statistics in parentheses; * $p<0.05$; ** $p < 0.01$; *** $p < 0.001$; Coefficients for the interaction of the high-SES control group with parental Chance orientation and the sampling location are not shown.
Source: Own calculations based on briq Family Panel waves 1 - 8.

8.6 Discussion

The evidence above indicates that the low intensity mentoring program did not affect generalized locus of control. When individual dimensions of locus of control are considered, the mentoring program had a small but significant effect on chance orientation: Children who were selected for the mentoring program believed on average to a lesser degree, that how their life goes was determined by luck and fate than low-SES children from the control group. This treatment effect was relatively robust across waves and remained stable until six years after the intervention. At some points, the chance orientation of the treated children had been reduced to such a degree that they were no longer statistically different from the children in the high-SES control group. The other two dimensions of locus of control were not affected by the mentoring program. Contrary to the formulated hypotheses, children who had been selected for the mentoring program had not become more internal through the mentoring, nor did they feel less determined by powerful others. These results are less surprising once one considers that the chance dimension is the only dimension in which mentors were significantly different from low-SES parents. Thus, chance was the only dimension in which mentors could effectively bring new ideas and perceptions to the treated children. The hypothesis that children who are more external at the beginning might profit more from the mentoring relationship could not be supported. Further analyses also indicated that the mentoring program complemented the influence of parental control orientations on children's control orientations rather than compensating them.

8.6.1 Compatibility with prior research

How do these results fit with prior research on the malleability of locus of control? The literature reviewed above indicates that generalized locus of control *can* be affected by interventions that target the evaluative process directly (Rosenbaum et al., 1991) or more indirectly through experiential learning (Gottschalk, 2005; Hans, 2000). Most of the reviewed intervention programs that successfully affected generalized locus of control were rather intense in terms of the amount of time the targeted population spent with the intervention program. Additionally, the programs were frequently delivered by trained professionals. Some of the studies investigating the malleability of locus of control in an experimental framework also found no significant treatment effects on generalized locus of control, although changes in locus of control in the treated group in the expected direction could be observed (Somers et al., 2016). Programs of lower intensity or shorter length often found that only the external dimension of locus of control was affected by the intervention (Dua, 1970; Nunn, 1995).

The intervention evaluated in this study was low-intensity, in several respects. Firstly, the targeted children spent only one afternoon a week with their mentors. Secondly, the mentoring program was programmatically not focused on changing control beliefs. Due to this programmatic freedom, it is difficult to evaluate the mechanisms through which the study might have affected locus of control. The programmatic freedom most likely led to a mixture of directly targeting children's belief systems through mentors' persuasion and more experiential targeting through vicarious learning by observing the mentor and own experiences of the conditionality of outcomes on own behavior. The intervention which was under investigation here might be considered a test of the lower boundary of requirements of an intervention program that still affects locus of control. Considering this, it is little surprising that no significant effects on generalized locus of control were found. Notwithstanding the program's low intensity and directedness, the Chance orientation of treated children was reduced significantly for several years. As pointed out by Levenson (1974), the Chance dimension is the utmost external dimension of locus of control, representing a fatalist worldview. While the belief that one is determined by powerful others or the general structure of society may motivate actors to free themselves from these influences, determination through pure luck and fate leaves no room for individual agency. The results of the present study suggest that the most external locus of control orientations are the first to change. In contrast, the orientations with regards to powerful others or the self are more difficult to affect and possibly take more intense intervention programs than the one tested here.

Overall the results of the present study appear to be in line with results from other experimental studies on the malleability of locus of control. Locus of control can be affected through active intervention, both directly and indirectly, at different points in the life-course. While more intense programs are able to affect general locus of control, including the internal dimension, less intense programs might still be able to affect the Chance dimension.

8.6.2 Limitations

The most disturbing limitation to this study is the weak and inconsistent measurement of the core concept: locus of control. Some changes to the measurement are undoubtedly warranted in the age range between 7 and 17. However, more comprehensive, validated measurement instruments would have been necessary to attain more reliable and valid measures of locus of control and its dimensions. More reliable measures may have increased the robustness and stability of the results. Unfortunately more comprehensive measures are not available within the briq Family Panel. This chapter has tried to deal with the measurement problem by using single items, or groups of items with high face validity for a particular dimension of locus of control. In this way, the collected information could be utilized to gain additional insights in the malleability of locus of control through a low intensity mentoring program. Unfortunately, the different waves' measurement instruments did not allow creating a dimensional indicator for each dimension in each wave. One particularly problematic case is the Chance dimension, which is only represented in the item-scales from the fourth wave onwards. This means that there is no way to test whether there was a treatment effect in the first two years after the program.[24] Additionally, the dimensional measures for Internal locus of control and Powerful others locus of control change across the waves. These changes in the measurement prevent comparing results across time. For the Chance dimension all measures are based on a single item. Unfortunately, measurement error is likely to be higher for single item measures.

Another central limitation is the significant difference between the low-SES control group and the treatment group in the powerful other's dimension at baseline. This significant difference is problematic. It indicates that the children in the treatment group were not sufficiently equal to the non-treated low-SES children at least regarding the Powerful others dimension of locus of control. Against this backdrop, it is even more unfortunate that there is no measurement of the Chance dimension available for the first wave. Hence it is unclear whether the observed differences between the treatment and the low-SES control group were already present before treatment. It could be, by chance, children in the treatment group were slightly less external from the very beginning, that is, before treatment. With the available data, it is impossible to test whether children in the treatment group

[24] There is some evidence in the literature that changes locus of control do not follow the intervention directly but come later (Henderson, 2009).

were less external in general or differed only in the powerful others dimension. This limitation casts some doubt on the results for the Chance dimension. On the other hand, the significant difference may also be due to measurement error. The fact that the treatment effect for Powerful others is not very stable across time lends at least some credibility to this alternative explanation.

8.6.3 Recommendations for further research

The non-academic and, to a lesser degree, parts of the academic discussion on locus of control are mostly focused on increasing internal locus of control since many outcomes, which are generally considered desirable, have been found to be associated with more internal locus of control orientations. This debate is based on a uni-dimensional concept of locus of control. The dimensionality of locus of control is, however, far from clear. Experimental studies on the malleability of locus of control, including the present one, suggest that adopting a multidimensional concept of locus of control is useful for studying the effectiveness of particular interventions on locus of control. To complement this research on the generative process of locus of control, it would be necessary to investigate the associations of certain life outcomes also with regard to the individual dimensions of locus of control. It may well be that certain important life-outcomes are more associated with one particular dimension of locus of control.

The evidence presented here suggests that there is hardly any variation in internal locus of control. Most individuals believe strongly that they themselves are responsible for their own outcomes. The dimension which differentiates individuals appears to be the external dimension. This shows that a multidimensional concept of locus of control is useful for uncovering individual differences in locus of control and the precise mechanisms through which locus of control is generated and through which locus of control contributes to certain important life outcomes. Especially for a research program that is concerned with resilience to adverse conditions and equal opportunities, the external dimension of locus of control appears to be central. Future research concerned with equality of opportunity should maybe invest more time and interest in the external dimension of locus of control. Moreover, more experimental studies are needed that investigate the long-term effects of particular intervention programs.

None of the studies reviewed above followed the participants for more than five years.[25] The present study is the only one that has shown lasting effects of a low-intensity intervention program on locus of control. Lasting effects may be a decisive argument in favor of the implementation of a particular program. Therefore experimental studies should be designed to be able to test short- as well as long-term effects.

As far as the briq Family Panel is concerned, introducing a more precise multidimensional measure of locus of control might be desirable in at least one of the waves to come. Considering that the treatment effect on the chance scale no longer existed in the eighth wave, a more precise measure of the chance scale in the ninth wave may be useful to gain certainty about whether the treatment effect leveled off. The German version of the IPC Scale by Krampen (1981), for example, contains eight items for each dimension and would provide a well-validated measure of locus of control. Including the 16 items for the two external locus of control dimensions might help to validate the results found in this study.

8.7 Conclusion

The present study tested the effect of a one-year low-intensity mentoring program with great programmatic liberty on the locus of control orientations of children from low-SES households over the course of eight years. Unfortunately, the low validity of the applied measurement instruments prevented conclusions on generalized locus of control in most follow up periods. When generalized locus of control was treated as a multi-dimensional measure that consists of an internal dimension and an external dimension that comprises a chance orientation as well as a powerful others orientation, the mentoring intervention was found to reduce the treated children's chance orientation in a significant way until seven years after the treatment. The internal and the powerful others dimension were not significantly affected by the mentoring program. These results are less surprising when one considers that the chance dimension was the only dimension in which low-SES children differed from high-SES children and in which the mentors were different from the parents of treated children. These results thus suggest that the Chance orientation plays a central role in the social gradient that has been identified in locus of control orientations. The study results are in line with other intervention studies targeting locus of control that also found

[25] Gottschalk (2005) found lasting effects of employment on locus of control after 36 months.

that the intervention programs mainly affected the external dimension of locus of control. Together these results indicate that the social gradient in locus of control orientations is mainly due to different perceptions of the role of chance and fate in determining important life outcomes and that these perceptions can be altered by intervention programs.

The analysis in this chapter contribute to the literature on the effect of interventions on locus of control, by testing the effectiveness of a low intensity low-cost mentoring program delivered by volunteers. Most of the existing studies tested the effects of more intense intervention programs delivered by professionals. Future research on the locus of control construct that is concerned with individual differences in locus of control across different socio-economic strata is advised to treat locus of control as a multi-dimensional construct and to measure each dimension precisely. Differences between socio-economic groups appear to manifest primarily in the external dimension. Considering further that the chance dimension was the only dimension in which low-SES children were different from high-SES children, the present results, together with the results from former studies, might be considered promising news for those concerned with equalizing the starting positions of children from different backgrounds with regards to locus of control.

Chapter 9

General discussion and conclusion

"... grant me the serenity to accept the things I cannot change, courage to change the things I can, and wisdom to know the difference."

(Reinhold Niebuhr)

9.1 Summary of the research

Locus of control has been repeatedly and robustly associated with a number of status indicators, such as educational attainment and income, but also with other desirable aspects of life, including better physical and mental health. At the same time prior research suggests that locus of control is associated with the person's position in the social structure throughout the life-course. The social-divide starts opening up at an early age and persists into adulthood. This social gradient in locus of control thus poses a threat to the societal aim of fair equality of opportunity. This dissertation set out to assess the role of locus of control in the intergenerational transmission of social status, and the potential to raise fair equality of opportunity through reducing the social gradient in locus of control.

9.1.1 Theoretical contribution: A theory of status reproduction through locus of control

The *theoretical part* of this dissertation traces in detail the mechanisms through which social status affects locus of control within one generation and across generations. It also explicates the function of locus of control in determining effort and thereby explains why locus of control is connected to such a broad variety of outcomes.

It is argued that locus of control beliefs reflect individuals' actual abilities to affect their outcomes. Individuals' actual abilities to affect their outcomes are determined by their SES, i.e., the total amount of different types of resources to which they have access. Internality is expected to increase with the total amount of resources that is available to a person, externality is expected to decrease as social status increases. Differences in locus of control that are due to differential access to resources are exacerbated further by a set of psychological and cognitive mechanisms, which allow the individual to maintain or enhance positive evaluations of the self. In sum, individuals of higher social status are expected to be more internal (less external) than individuals of lower social status and vice versa.

Following Bandura's (1977b) theory of social learning, individuals learn from their own experiences, but also by observing others (vicarious learning) and by listening to others (persuasion). The theory chapter discusses how parental social status affects children's locus of control beliefs via all three sources of learning. First, parental social status is hypothesized to affect children's experiences of control and contingency, by altering the quality and content of parent-child interactions. Social class differences in the quality and content of parent-child interaction can be explained by cultural/functional and resource-based arguments.

The cultural explanation builds on the studies of Melvin Kohn and his colleagues (1959; 1969) and holds that parents will aim to instill those values, characteristics and beliefs in their children, that prove to be functional in their own social environments. The occupational context of the parent, and hence the job characteristics that are typically found in a particular social class are hypothesized to determine these values, characteristics and beliefs. It is argued that high-SES contexts value autonomy and responsibility and thus foster internality, while low-SES contexts value conformity and obedience and thus at least impede internality, or even foster externality.

The resource-based explanation builds on the Family-Stress-Model (Elder et al., 1992) and a formalized and extended version of it by Cobb-Clark et al. (2019). When resources (of all kinds) are abundant, parents are hypothesized to have more cognitive, emotional and financial resources for their children. This allows high-SES parents to create more responsive and predictable environments for their children, to engage more actively in the development of their children and to pay for activities which allow the children to experience the contingency of outcomes on their behavior; thereby fostering their children's internality. Scarcity of resources in the parental household, in contrast, is hypothesized to reduce parental responsiveness and interest in their children's development and daily activities, because parents will be busy trying to make ends meet, finding a new job etc. When parents are overwhelmed by the problems they face, and sources of emotional and social support are lacking, their parenting may become more erratic, less predictable and they may be at greater risk of using harsh discipline. Unresponsiveness, unpredictability and harsh methods of discipline are expected to breed external control beliefs and feelings of helplessness.

Second, children's locus of control orientations may be affected by vicarious experiences of helplessness and lack of control in their direct social environments and their parents' lives in particular. Finally, children's locus of control orientations may be directly affected by their parents' locus of control orientations through persuasion.

All three sources of influence suggest that children from low-SES households are less internal (more external) than children from middle- and high-SES households.

Locus of control is predicted to affect status-related outcomes by moderating the perceived return to effort and investments in the future. The amount of effort a rational agent would be expected to exert to attain a particular outcome is expected to decrease with the level of uncertainty in the association between the exerted effort and the desired outcome. Externality is predicted to attenuate effort, as it adds a certain level of uncertainty into the association between effort and outcome. Internality sets the stage for purposeful action, by reducing this level of uncertainty. Externality is therefore associated with reduced effort, while internality sets the stage for purposeful action. Perceiving locus of control as an effort moderating belief, explains why locus of control has been robustly associated with many status-related outcomes.

In sum, the theoretical mechanisms above suggest that children from low-SES families are more likely to entertain locus of control beliefs that undermine effort and less likely to entertain those locus of control beliefs that are required for motivated action. High-SES children in contrast, are more likely to entertain these.

9.1.2 Empirical contribution: An estimation of the substantive relevance of the hypothesized transition mechanism and the potential for intervention

The *empirical part* of the dissertation aimed to assess the substantive relevance of locus of control in the transmission of social status from one generation to the next, and the potential to enhance equality of opportunity by reducing the social gradient in locus of control.

The *substantive importance of locus of control in the transmission of social status from one generation to the next* was assessed in a path-analytical framework using SEM on data from the 1970 British Cohort Study. This data-set was chosen because it provides rich and prospectively measured information on the conditions in which the children grew up and prospective measures of their social status in middle-adulthood, when status attainment can be expected to have peaked. Moreover, the data-set provides an early measurement of locus of control, taken at the age of ten. Given that locus of control is constantly updated, it is important to measure locus of control early in life when one wants to assess its role as a mediator of social status. To allow for a better understanding of the substantive relevance of locus of control in the status transmission process, the share of the association between parents' and children's status that is explained by locus of control was compared to the share explained by cognitive skills. Additionally, joint effects of parental social status and locus of control on status attainment were investigated, to test for potential mechanisms of cumulative (dis)advantage.

The findings indicate that locus of control mediates the influence of social background on education, hourly gross wages, and occupational status. Children from high-SES households are more likely to hold the type locus of control beliefs that have a positive effect on education, wages and occupational status. For all three status attainment variables, a large part of the influence of socioeconomic background on the status outcome is direct (education: 62%; occupational status: 31%; wages: 39%). Cognitive skills were found to mediate a larger part of the influence of socioeconomic background on status attainment than locus of control. Locus of control mediates roughly a tenth of the total effect of socioeconomic background on education (compared to almost 30% for cognitive skills). For occupational attainment and gross hourly wages, locus of control mediates 15% of the total effect of socioeconomic status respectively (compared to one third and one quarter for cognitive skills). Education mediates a little more than 20% of the total effect of SEB on occupational status and gross hourly wages. Hence, locus of control is just a little less important than education in the transmission of social status from one generation to the next. Considering the relative importance of locus of control in the intergenerational transmission of social status, it is rather surprising that it has remained under the radar of educators and policymakers for so long. Further analyses revealed that SEB and locus of control have independent effects on all three status outcomes. Once obtained locus of control benefits individuals from all social classes equally.

Hence intergenerational status transmission might be reduced by about 10%, if social-class differences in locus of control could be entirely eradicated. The real potency of this lever is however determined by the extent to which locus of control is socially formed in different institutional settings rather than genetically determined. Detailed knowledge on the influence of different types of social actors (family, peers, institutions) at different points in the life-span is required to design cost-efficient, yet effective programs to reduce social class differences in locus of control. Therefore, the remainder of this dissertation was dedicated to assess the influence of genetic and different types of social factors on locus of control at different points in the life-span.

The investigation of the *degree to which locus of control is genetically determined* utilized data from TwinLife, a multi-cohort panel study of German same-sex twins and their extended families to decompose the variance in reported locus of control into its genetic and social components, based on the classical and the extended-family twin design. Using also information on other family members' locus of control, the extended twin design is able to circumvent a number of problems that plague the classical twin design, which typically lead to an over-estimation of genetic factors and an under-estimation of shared-environmental factors. The extended twin model was only used for the older cohorts of the twin model, where the locus of control measures for parents and children were the same.

The results of a classic twin-model, implemented as a two-group structural equation model, indicate that locus of control is mostly socially determined. For the age group between seven and fourteen internal and external locus of control was entirely socially determined. Best model fit was achieved by a model which explains all observed variation in locus of control by a shared- and non-shared environmental factor. One-fifth of the variation in internality, and one-third of the variation in externality was explained by factors that were shared by twins. For twins aged 18-24 the observed variance-covariance structure was best explained by the extended family twin model. The results indicate that genetic factors explain 16% of the variation in internality and 17% of the variation in externality. Compared to other personality traits, such as the Big Five, the genetic contribution is relatively low (for the Big Five, heritability ranges between 40% and 60%). Considering, however, that locus of control is a belief, that is generalized from a history of experiences the large degree of social determination was expected. Previous twin studies on the genetic determination of locus of control yielded higher estimates of heritability, but all of the previous studies utilized the classical twin design, which is known to yield upwardly biased estimates of heritability.

The evidence thus suggests that the contribution of genetic and environmental factors changes across the life-course. In younger ages, environmental factors shared by twins (such as their family environment, or a common school, teachers and group of friends) seems to play a greater role than in young adulthood. Instead, the effect of genetic set-up appears to materialize in young adulthood. Shared-environmental factors no longer contribute significantly to locus of control in young adulthood. Further evidence for all age-groups is needed to determine how the heritability of locus of control changes across the life-span, but the evidence in this study suggests that the heritability increases with age. If this pattern were confirmed, locus of control would be more similar to intelligence, than to other personality traits in this respect.

The statistical insignificance of shared environmental effects in the older-cohorts does not mean that family or other shared environments are not important. It may just mean that shared-environmental factors influence individuals in idiosyncratic ways (and thus become non-shared). This happens when the same events are interpreted and reacted to in different ways. The fact that two-thirds to three-quarters of the variation in locus of control was attributed to environmental factors which are not shared by twins may indicate that gene-environment interactions play a significant role in the determination of locus of control. Initial descriptive analyses indicated that externality may be socially triggered.

In sum, locus of control seems to be socially learned rather than genetically determined. Hence, it may be susceptible to targeted intervention. Genetic determination seems to limit the openness of locus of control to intervention only at a minor level. The question that automatically arises, then, is what a successful intervention strategy would look like. At what age should it be implemented, in which institutional context, by whom, for how long, and what should be the content of such an intervention.

The final empirical chapter therefore investigated the *causal effects of a low-intensity mentoring intervention on low-SES children's locus of control*. It based on evidence from the briq Family Panel Study, which follows the participants of a randomized, controlled one-year mentoring intervention conducted in 2012 until today. Treated children received mentoring from a volunteer (mostly university students) for one afternoon a week over the course of one year. Their locus of control development could be compared to that of two control groups: one low-SES control group that had the same characteristics as the treated children, and one high-SES group of children from middle- to upper class families. Due to the randomized allocation of the low-SES children to treatment and control, observed differences between treatment and control group can be interpreted as causal of effects of the mentoring intervention. The analyses extend the literature on the effectiveness of interventions on locus of control by testing a low-intensity, general intervention, delivered by lay-persons at little cost. Mentors would meet with their mentees for one afternoon per week and they were entirely free to structure the time with the children according to the children's needs and interests. They were merely advised to treat the children as 'benevolent friends'. The panel structure also allows testing for long-term effects of the intervention.

No treatments effects were found for internality and feelings of externality due to powerful others. However, children who had been selected for the mentoring program believed, on average, to a lesser degree that their lives depend on luck and fate until 7 years after the intervention. Treated low-SES children were no longer different from the high-SES group. These results are little surprising once one considers that the chance dimension was the only dimension in which mentors were different from low-SES parents. Thus chance was the only dimension in which mentors could effectively bring new ideas to the treated children. The hypothesis that initially less internal children would benefit more from the mentoring was not supported. There is some evidence that the intervention was slightly more effective for boys than for girls. Moreover, the mentoring did not affect the importance of parental locus of control for children's locus of control. The parent's chance orientation and the mentoring intervention appear to have independent effects on children's fatalism.

9.2 Theoretical and practical implications

9.2.1 An ecological model of the development of locus of control

One critique of the recent locus of control literature, that uses locus of control as a predictor of all sorts of outcomes, was that it was under-socialized. It considered locus of control as if it had come to existence in a social vacuum. One aim of this dissertation was to add some (social) atmosphere to this research, by explicating how a person's locus of control is affected by their placement in the social world, and the socio-economic structure in particular. This aim was pursued implicitly in the previous chapters. This section aims to make the results of this endeavor more explicit.

The influence of the *macrosystem* (captured in the principle of time and space in the life-course approach) should be relatively similar for adults and children and thus can be treated jointly. The characteristics of the current macrosystem arose from the joint occurrence of a number of processes that sociology typically refers to as *Modernization*. Modernization is characterized by increasing structural differentiation, cultural rationalization, personal individualization and increasing domestication of nature (van der Loo and van Reijen, 1997). All of these processes impinge upon the predominant conception of locus of control as well as the level of control individuals can exert over their lives.

On a more general level, natural domestication, i.e., increases in the control over nature and natural phenomena through technological (and medical) advancements, placed the *locus of control* within the human species. Scientific endeavors to gain control over the climate, human mortality, some distant places in outer space, or to create *and control* artificial super-intelligence illustrate the ethos of control that underlies the current system of beliefs. Anything can be controlled by man. Externalism is constructed as irrational. Religion is accepted as form of cultural organization that is functional in some form, but many other narratives of external control are denigrated to *conspiracies* and placed outside the Overton-window, to contain their distribution. Basing one's decisions on the current constellation of the moon and the stars, or rejecting medical treatment because one believes it is one's fate to die from a perfectly treatable disease are frowned upon and typically not accepted as rational. The general belief system is thus one that embraces internality and denigrates externality. In line with these thoughts social psychological research has provided evidence in favor of a societal '*internality norm*' according to which internality is socially valued (Beauvois and Dubois, 1988; Dubois and Beauvois, 2008; Pansu et al., 2008). Pansu et al. (2008) for example provide evidence that the internality norm is conveyed to children in educational institutions. Dubois and Beauvois (2008) go one step further and discuss whether internals are more successful *because* social appraisers, in schools, organizations and courts of justice remunerate internality.

Structural differentiation and cultural individualization directly impinge upon individuals' abilities to control their lives. Increasing structural differentiation entailed increased functional specialization, for example in the occupational realm, but also in the organization of society. Occupational specialization is at the root of class-differences in distribution of resources, which has been shown to have a direct effect on locus of control above. The decentralization of autonomy in all realms of life and increasing cultural and normative pluralization and individualization have undermined structuring function of cultural norms, traditions and rigid societal structures. Individuals are now free to choose their education, their occupations, their religion, their sexual orientation and even their gender. The loss of a unified source of guidance and structure has, however, also left a void that has to be filled by the individual itself. The general societal trend towards more freedom of choice, more individuality and greater individualized responsibility not only enables internality, but actually forces it upon the individual. Cross-cultural investigations of locus of control show that population-means in internality increase with the level of economic development and individualism (Dyal, 1984; Park and Lau, 2016; Shane and Heckhausen, 2017).

Rosa (2014) argues, however, that these processes have reached a turning point. The effects of man-made climate change can no longer be controlled. The current COVID-19 pandemic has 'domesticated' the human species for over a year. Religious fundamentalism and conspiracy theories are upsurging, thereby counteracting the process of rationalization. Processes of de-differentiation are more common in individuals private and professional lives (e.g. for many workers, boundaries between work and private life are becoming blurred; in science, the boundaries of disciplines are becoming more blurry again); the empowerment that was brought about by increased individualism may feel overwhelming and the increasing acceleration and competition in a globalized world, demands to respond to these processes may also incur feelings of powerlessness and determination.[1]

In line with these hypotheses Twenge et al. (2004) found a trend towards greater externality in college students and nine to fourteen year-olds between 1960 and 2000 (Twenge et al., 2004). According to their study, the average college student in 2000 felt more determined than 80% of the children in the 1960s. Using data on four generations of families from the Longitudinal Study of Generations Gatz and Karel (1993) found a trend towards more internality between 1971 and 1991 for all subgroups except for young men. It thus seems that while the dominant belief system is one of internality, feelings of externality are increasing especially among young individuals.

At the level of exosystem, locus of control of adults and their children is affected by the distribution of resources within a society, as the theory section has shown. Empirical evidence on children who grew up in the 1990s and early 2000s suggests that parental social status remains a major determinant parents' valuation of obedience and independence (Park and Lau, 2016; Tudge et al., 2000). In the empirical investigations in this dissertation, internality was found to differ between high and low-SES children born in 1970 when the children were 10. For the two studies that focused on younger birth-cohorts, no social class differences in internality were found in mid-childhood. In the mentoring study, there was no social gradient in internality between low-SES parents and high-SES parents and mentors, which were mostly university students. The twin study, did however find social class differences for internal locus of control among the young-adults. Externality seemed to be more affected by social class. In the twin study, children and adults from low-SES contexts were found to be more external. In the mentoring study, low-SES children and their parents were found to be more fatalistic than high-SES children, their parents and the mentors. The position in the social structure thus seems to affect locus of control beliefs, albeit children in younger birth cohorts seem to differ only in their external control beliefs,

[1]Note, that what has been argued for the individual seems to find a reflection at the societal level. Greater ability to affect outcomes as determined by the amount of capital that is available to a society (in terms of its level of development as measured by GDP and the body of knowledge and technology that are available in the country) are associated with mean-level locus of control at the societal level. As for the individual level, there may, however, be a threshold beyond which greater internality becomes dysfunctional. This threshold would be reached when the societal level of internality exceeds the level of internality that is justified, based on the level of development and body of knowledge. Such *hubris* may backfire, for example when geo-engineering goes wrong, super-intelligence cannot be controlled or religious fundamentalism and conspiracy theories find supporters in search of simple truths (Miegel, 2014; Rosa, 2014).

but not with regards to their internality.

For children, the parental workplace is part of the exosystem, as it does not contain the child directly but impinges upon their locus of control development. As argued in Section 5.3 children's locus of control is affected indirectly by their parent's job-characteristics via parents parenting goals, but it may also be indirectly affected by the parental workplace via parents emotional and cognitive resources. Unexpected paternal job-loss for example has been shown to decrease children's internality via an increase in parental distress (Peter, 2016).

Finally locus of control is affected by interactions at the micro-level. For adults, the workplace environment has been argued to be a major determinant of own locus of control. Children's locus of control was argued to depend chiefly on the type, quality and content of interactions with their parents. Ample evidence was cited for both. The original research in this dissertation further showed, that factors shared by twins could explain roughly 20% of the observed variation in internality and one third of the variation in internality in middle-childhood. The rest of the variation in locus of control in middle childhood was explained by factors that were not shared by the twins. Later on, in early adulthood the importance of non-shared environmental factors increased further, determining roughly 80% of the observed variation in internality and externality. The intervention study showed that even relatively short relationships with benevolent others have the power to reduce fatalism in low-SES children in the medium-run.

9.2.2 Locus of control should be considered as a multi-dimensional construct

One theoretical implication that can be drawn from this dissertation is that locus of control should be considered a multi-dimensional construct. According to Rotter (1966), locus of control captures highly generalized expectations of the degree to which own behavior is productive of certain results or not. Locus of control can thus be understood as a belief about the degree of uncertainty that is attached to the relation between own actions, or effort, and outcomes.

In this context, the *dimensionality of locus of control* becomes theoretically important. External control beliefs are a source of friction in the motivational process. The amount of effort that a rational agent would exert is expected to decrease with the degree of uncertainty attached to the association between the exerted effort and the occurrence of the desired outcome. Hence externality is expected to dampen purposeful activity and effort. Internality, in contrast, indicates a stronger perceived association between effort and outcomes and thus set the stage for purposeful action. Note, however, that internality in and of itself is not sufficient to evict effort. Purposeful action will only be initiated if a) the goal is perceived to be valuable, if b) the person is aware of a strategy to attain the goal (strategy beliefs) and if c) they are convinced that they have the capacity to enact that strategy (agency beliefs). Externality's effort-attenuating effect operates irrespective of agency and strategy beliefs. Fatalism may be particularly detrimental to effort, because it allows no room for improvement (Levenson, 1974). Put shortly: *Externality, and fatalistic externality in particular, is sufficient to undermine effort. Internality, in contrast, is necessary but not sufficient to initiate effort.* Therefore, externality is predicted to be more detrimental to effort and investment than internality is conducive to it. This *difference between internality and externality in the logical relation to outcomes has been put forward as a theoretically derived argument to consider locus of control a bi-dimensional construct.*

When locus of control is understood to be a bi-dimensional construct, one dimension - externality - would be predicted to have a greater impact on outcomes, as it suffices to attenuate efforts. In the case of a uni-dimensional conception of locus of control, the theoretical reflections above would imply non-linear effects of locus of control: Changes at the internal end of the distribution would be predicted to have less of an impact than changes on the external end of the distribution.

In the empirical literature the distinction between agency, means-ends, and control beliefs is seldom made. Empirical measures of locus of control often measure a mix of agency and control beliefs. Sometimes items intended to measure external locus of control are reverse coded and taken to measure internal locus of control. All of this obscures more fine-grained mechanisms such as those proposed by the hypothesis above. In order to test the proposed asymmetry in the effects of internality and externality on effort, control beliefs, agency beliefs, strategy beliefs and the perceived value of the outcome would need to be measured distinctly. More on this will be said in the section on recommendations for further research.

9.2.3 Locus of control is more skill than trait

Section 3.7 asked whether locus of control should be considered as a trait or a skill. The argument that locus of control should be conceptualized as a '*trait-like personality characteristic*' was based on the argument that it is more trait-like than state-like (Wallston, 1992), and that it has *functional properties*, in the sense that it constitutes a predisposition to respond in a certain manner (Turnipseed, 2014) and thus predicts behavioral responses in a relatively stable manner, that holds across situations, thereby complying with conventional definitions of personality (Rotter, 1975; Specht et al., 2013). The empirical evidence on mean-level and rank-order stability indicates, however, that locus of control is less stable than the Big Five (Specht et al., 2011b, 2013).

Green(2013) defines skills as personal qualities, which are a) productive of some value b) can be enhanced by training and development, and c) are socially determined. The analysis in this thesis have shown that locus of control fulfills all of these criteria. The evidence in the literature review strongly suggests that locus of control is productive of individual and societal value. The Chapter that reviewed the evidence of locus of control interventions and the evaluation of the mentoring intervention has shown that locus of control can be enhanced by training and development and the review of behavior genetic research in locus of control revealed that it is at least partly socially determined.

Hence, there are good arguments or locus of control to be considered a trait-like characteristic. At the same time, the empirical evidence justifies its characterization as a skill. If only the evidence from this thesis were considered, locus of control would rather be categorized as a skill than as a trait.

9.2.4 Is more internality always better?

So far, this dissertation was largely written from a standpoint that considers internality as good, or desirable, and externality as bad, or undesirable. This standpoint reflects the predominant notion in the current locus of control literature (partly reviewed in Chapter 4). This dissertation should not end, without asking whether this notion is warranted, and where it reaches its limits. There are theoretical, as well as empirical arguments that question this notion. Both will be briefly discussed in this section.

Both sides of this debate are backed up by *theoretical accounts.* As already discussed in the Theory Chapter, *theory of illusory control as false conscientiousness* would argue that more internality is always better, even if it is illusory, because it reduces distress that is associated with uncontrollability and uncertainty (Kluegel and Smith, 1986). The *consolation-price* theory, in contrast, recognizes the psychologically protective function of externality. The *threshold of dysfunction* theory, and the theory of *instrumental realism* even go one step further, asserting that greater internality becomes dysfunctional when it is harshly in excess of a person's realistic opportunities of control (Mirowsky and Ross, 1990a; Wheaton, 1980). Rotter captures this point when he highlights that "Many people may already, feel that they have more control than is warranted by reality, and they may be subject in the future (or may have already been subjected) to strong trauma when they discover that they cannot control such things as automobile accidents, corporate failures, diseases, etc." (Rotter, 1975). Or as Mirowsky and Ross (1990b, p. 1520) put it, making the connection to a person's position in society: "People cannot find happiness by cutting themselves completely loose from reality. At every level of status, there is a limit to the subjective value of a greater sense of control. The limit increases with status, but it does not disappear". Hence, more internality may not always be better. Externality may be *rational* in some situations, simply because it is a realistic appraisal of the present situation, and - irrespective of its ontological correctness - externality may serve a *psychologically protective* function.

There is also a small body of literature that shows that externality may be useful at times. Specht et al. (2011b), for example, found that individuals with greater external control beliefs experienced a less intense decline in life-satisfaction due to the death of their spouse than individuals with low-external control beliefs. The empirical evidence that aimed to test the theoretical predictions of consolation price theory and the threshold of dysfunction theory yielded mixed results (Kiecolt et al., 2009; Mirowsky and Ross, 1990a). It seems that more does not provide comfort in the sense of improving individuals affective states (Kiecolt et al., 2009). There is however evidence that suggests that greater externality may allow individuals to maintain positive self-evaluations (Weary, 1979; Zuckerman, 1979). Furnham and Steele (1993) also pointed out some of the negative consequences that internality may have in the interpersonal contexts. Because internals more readily ascribe responsibility for outcomes to themselves, they may be less resilient to experiences of failure, and they may be less empathetic with others who are in help of need. Furnham and Steele (1993) argues that externality may be associated with altruism and more collectivist attitudes while internality may be associated with harsh individualism. The empirical evidence thus suggests that, more internality is not always better.

The discussion on *whether more internality is always better* can be settled in two ways. The first, takes the discussion to a higher level, by acknowledging that what is desirable, is culturally relative and can only be answered within a certain cultural framework. The second settlement is again based on the bi-dimensional understanding of locus of control and argues that both internality and externality are positive, if they are applied correctly.

On a more general level, the value of any trait is culturally relative. Rotter (1975) points out that internality does not automatically imply better adjustment. “Adjustment, after all, is only a value concept, and (...) must depend upon the definition of adjustment” (Rotter, 1975, p. 60). According to this view, internality would be “genuinely desirable in a culture that presupposes its truth, and undesirable in a culture that does not.’ (...) Likewise, fatalism is genuinely desirable in a culture that presupposes its truth and undesirable in a culture that does not” (Mirowsky and Ross, 1990a, p. 1512). Considering the evidence cited in Section 9.1.1, it appears evident that the present society is one which presupposes the truth of internality, or at least, demands it. Fatalism, in contrast, is frowned upon and seen as a “self-defeating belief that sustains and regenerates the conditions under which it is realistic and comforting” (Mirowsky and Ross, 1990a, p. 1512). The discussion above argued that we do live in a society in which the truth of internality is presupposed and socially valued. Hence, internality should be fostered, but that does not mean that externality is bad.

When locus of control is conceived as a bi-dimensional construct, the joint benefits of greater internality and a realistic appreciation of the limits of one’s own control are no longer a contradiction. In fact, *the most rational, or functional stance may be one that at the same time appreciates the realistic limits of control, while upholding internality with regards to those things that are within the limits of control.* Once locus of control is considered bi-dimensional both aspects can be forested. Internality is not good or bad per se, neither is externality. Both may be functional or dysfunctional, depending on whether they are based on a realistic assessments of the boundaries of control.

9.2.5 Practical Implication

What practical implications can be drawn from this dissertation? 10% to 15% of the association between parents' and children's status attainment are due to social class differences in locus of control. Luckily locus of control seems to be the result of an individual learning process and open to intervention. It thus seems that locus of control may provide a lever to enhance fair equality of opportunity. Locus of control is believed to be a particularly powerful lever, because it is such a high-level trait, that will affect a number of other desirable traits, such as Conscientiousness or Grit. It may also be particularly apt for intervention as it is less genetically determined than other traits that have been connected to status attainment such as Conscientiousness. In what way does this lever have to be applied to be cost-effective and efficient?

Focus on Fatalism: The Theory chapter has argued that externality is more detrimental to effort than internality is conducive to it. In line with this argument, Furnham and Steele (1993) observed that externality is empirically related to achievement outcomes, while internality is related to self-esteem and self-acceptance. In some empirical studies, external locus of control has been found to be more predictive of economic outcomes than internality (Caliendo et al., 2015; Heineck and Anger, 2010). Within external control beliefs, fatalism is particularly detrimental. In contrast to externality due to powerful others, fatalism does not leave any room for improvement (Levenson, 1974).

At the same time, internality did not differ significantly between high- and low-SES children in the two studies based on younger birth-cohorts. Other studies on younger birth cohorts also found no significant association between parental status and internal locus of control (Ng-Knight and Schoon, 2017a). What seems to differentiate children from high and low social contexts, is the degree to which they embrace externality. Further evidence will be necessary to support this claim. The evidence that was collected in this dissertation suggests, however, that in order to reduce the social gradient in locus of control, external control beliefs and fatalism in particular need to be targeted.

Targeting external control beliefs may also be more cost-efficient. The empirical literature on locus of control intervention suggests, that external locus of control is changed more easily than internal locus of control. Programs that successfully affected internal locus of control were rather intense in terms of the amount of time the targeted population spent in the program. Moreover, these programs were often delivered by trained professionals and therefore rather cost-intensive. Programs of lower intensity and length often only affected the external dimension (Dua, 1970; Nunn, 1995, Chapter 8).

Taken together, this evidence suggests that fair equality of opportunity can best be enhanced by targeting external control beliefs, and fatalism in particular. Regardless of the dimension that is targeted, any program targeting locus of control directly should contain training elements that help individuals to *realistically* assess what they can change and what cannot be changed. Some things in life cannot be changed. Driving individuals blindly towards internality and away from externality may be harmful, when it is not accompanied by a realistic assessment of what lies within individual control, and what doesn't. At the very least, individuals can always strive to control their own reactions to external situations, even if the situation as such is not controllable. Fostering realistic assessments of what can and what cannot be controlled becomes even more important in the face of a general time-trend (Park and Lau, 2016) and a societal norm for internality (Dubois and Beauvois, 2008). At the societal level, it will be important to clarify that the limits of control may differ from one individual to another. Physical, cognitive and psychological limitations may alter individual's ability to control their environment just as much as their socio-economic background. Creating an understanding of such differences in the actual ability to control one's environment is necessary to maintain and enhance empathy and maintain social cohesion.

Focus on children and their parents, but not the family: According to the theory developed in Chapter 5 social class differences in parent-child interactions are at the root of the observed social class differences in locus of control. Ample empirical evidence was cited to back up this claim. If the cause is within the family, it has to be treated within the family, one may argue. Parent-child interactions within the family context may, however, not be the most efficient way to tackle this problem. The family is a sanctuary and interventions within the family context are frequently met with a good deal of reluctance from those targeted and society at large (Heckman and Masterov, 2007).

The discussion of methodological weaknesses within this literature (Section 5.3.3) also suggested that familial effects on locus of control may be actually smaller than what the empirical literature suggests. This is in line with the evidence from the twin study, that suggests that large parts of the variation in twin's locus of control can be attributed to environmental factors that are not shared by the twins. The intervention study also suggests that even interventions of relatively low intensity outside the familial context have the power to alter low-SES children's locus of control. Other intervention programs that were delivered within the school-context, or as part of leisure-time activities also yielded respectable results.

Previous intervention studies showed that general and domain-specific locus of control can effectively be changed through programs targeted at locus of control (Rosenbaum et al., 1991), but also through experienced based programs (Gottschalk, 2005; Hans, 2000), at least in the short run. Support for low-SES children within schools, as part of neighborhood development projects and in the context of structured leisure-time activities is more readily accepted by parents and society and often demanded by the former and endorsed by the latter. Thus, intervention programs outside of the familial context seem to offer the more promising route towards the children's locus of control than interventions within the family. The evidence from the mentoring study however also showed, that the mentoring could not compensate the effects of low social status on locus of control.

Child-centered intervention programs may have to be complemented by other programs focusing on the parents and their lack of resources. The resource-based explanation for social-class differences in parent-child interaction pointed towards the importance of parents' cognitive, social, emotional and (but not only) financial resources. Parent-child interactions are hypothesized to deteriorate when parents are themselves overwhelmed and helpless in their situations. Therefore, one key strategy to improve fair equality of opportunity for children is to provide resources to the parents that allow them to handle their own situations. This may include free access to psychological support for example, that can help to improve parents own coping strategies.

Focus on early ages: Interventions should be implemented relatively early in life, possibly in early to mid-childhood and ideally before any important transition points in the school system. The theory has argued that advantages from an initially more internal (less external) locus of control accumulate over the life-course, because initial internality (low initial externality) will increase efforts and investments into the future, thereby increasing the probability of obtaining the desired outcomes. This experience of contingency forms the basis for the persons locus of control in the future. The same is true for externality, which reduces effort and thus creates experiences of non-contingency and irrelevance of the own behavior. Hence, over the life-course the positive effects of greater internality (less externality) accumulate. Cunha and Heckman (2007) call this the *self-productivity* of skills. The self-productivity of skills is one of the main arguments in favor of early investments (Heckman and Masterov, 2007). The mentoring intervention has shown that locus of control can be effectively changed in middle childhood. However, even earlier interventions may be possible. More research on the sensitive periods in locus of control development is needed to identify the optimal time point for early intervention.

Heckman and Masterov (2007) point out that investing early in low-SES children may be particularly cost-efficient. In the case of a successful intervention, this may not only benefit the children themselves, but also their children and society at large. Such effects may also apply in the present case: Successfully improving individuals locus of control may for example reduce societal costs through positive effects on individual's psychological and physiological health and faster return to the labor market after unemployment.

9.3 Recommendations for further research

9.3.1 A plea for conceptual precision

Locus of control research is plagued by a lack of conceptual precision, and by a multitude of measurement instruments, which are often inconsistently applied. As pointed out in Section 3.6, there is a number of related constructs, that refer to distinct aspects of the broader concept of perceived control.

The conceptualization by Skinner et al. (1988), which differentiates means-ends (or strategy) beliefs from agency beliefs and control beliefs, integrates a number of other accounts and is therefore rather comprehensive. In the empirical literature the distinction between agency, means-ends, and control beliefs is seldom made. However, "if researchers are interested in promoting a sense of control, then it would be important to attend to all of the system's elements –because each offers a window into a source of potential problems as well as into a source of potential remedies for improving this complex system" (Skinner, 2017, p. 316). Therefore a precise measurement of all these different elements would be important.

Another relevant aspect, that is frequently forgotten, is the distinct measurement of the valuation of the outcome. As Rotter (1975, p. 59) pointed out "[t]o make a locus of control prediction one must either control reinforcement value or measure it and systematically take it into account". Thus, it is important to integrate the perceived value of the outcome into empirical investigations of the effects of locus of control.

The conceptual confusion is made worse by the unsettled debate on the dimensionality of locus of control. This has led to an anything-goes mentality when it comes to the measurement of locus of control. Measurement constructs intended to be bi-dimensional are treated as uni-dimensional. Sometimes items intended to measure external locus of control are reverse coded and taken to measure internal locus of control. Original scales are shortened, and items with low loadings are dropped, assuming the content of the measurement construct remains the same. All of this, and the plethora of measurement constructs with different levels of specificity, that existed to begin with, limit comparability. In this dissertation alone, five different measurement instruments were used. As in other studies, items were dropped, and measurement model were adjusted to achieve acceptable model fit. Such changes can and should be taken into account when interpreting the results of the analyses.

There are good and bad consequences to these frequently observed adjustments in the empirical literature: If adjustments are properly reported and carefully interpreted, fine adjustments in the measurement constructs may provide novel insights into the function and importance of different elements of the locus of control construct. A diligent review of this diverse literature, may provide greater insights into the construct and its mechanisms than a never-changing measure would have yielded. On the other hand, comparability is reduced and generalization is hampered.

Empirical research on the locus of control constructs should take all of the aforementioned points into account. It should be aware that locus of control is only one element of the broader concept of perceived control, and that the other elements (means-ends beliefs, agency-beliefs and outcome-value) need to be measured or controlled too, in order to make useful predictions on locus of control. Such a precise measure of the construct would allow to uncover the fine-grained mechanisms underlying the association between locus of control (or self-efficacy) and various outcomes. Any adjustments that are made to existing measures of locus of control should be reported and discussed properly. Unified measurement of the construct - especially across age-groups - seems utopic at this point, but a greater clarity with respect to which specific aspect of the control concept is measured and what this means might at least create some order. Similar pleas for more consistent use of the locus of control construct have been made several times in the literature. A more comprehensive version is found in the 1993 Article by Furnham and Steele.

9.3.2 Open questions for further research

This dissertation set out to answer some questions and raised many more in the process. This section provides a short summary of the research requirements that have become apparent.

A central hypothesis that stands at the end of this dissertation is that social class differences in locus of control - especially among younger cohorts - are primarily due to the external dimensions of locus of control, and maybe fatalism in particular. Further evidence is needed on this questions. To answer this question, it is very important to carefully select measurement instruments that distinguish internal and external control beliefs in children with great precision.

The hypothesis that external control beliefs are more detrimental to effort than internal control beliefs are conducive to it also needs to be tested empirically. This question may lend itself well to be tested with an experimental research design in the laboratory. Experimental economists have come up with creative ways to measure effort and it may be easy to even manipulate individuals internal and external control beliefs in such a setting. Such experimental research should be complimented by survey-based research assessing the association between life-outcomes with the dimensions of locus of control. Again, precise measurement of internal and the different dimensions of external locus of control is central in this endeavor.

An interesting research project within sociology may be to test the theory of instrumental realism using an evaluative measure of well-being. So far, all tests of the unified theory of instrumental realism have operationalized the 'consolation' that may be offered by adopting more external control beliefs with affective measures of well-being (mostly feelings of depression and anxiety). The empirical evidence was only partly supportive of the theory. While the functional form was supported, the hypothesized threshold of dysfunction beyond which more internality would lead to a reduction in well-being was outside of the empirically observed range of internality. Consolation may come in different forms however. The literature on the self-serving attribution of responsibility argues that external control attributions are made to maintain a positive image of the self. It would be interesting to evaluate the theory of instrumental realism using an evaluative measure of well-being as an indicator of distress. Maybe, this would offer a 'rescue' to the consolation-price theory and theory of instrumental realism, both of which have been rejected empirically so far. In line with the argument made above that internality and externality should be treated separately, it might also be interesting to see whether dysfunctionality is related to internality or externality.[2]

From a more macro-sociological perspective, it might even be interesting to consider the possibility of a '*societal threshold of dysfunction*'. As pointed out above, cross-national evidence suggests that population means of internality increase over time and with economic development and the share of post-secondary enrollment (Park and Lau, 2016; Wright and Wright, 1976). Park and Lau (2016) report that this positive time trend is primarily driven by countries with lower levels of socio-economic development. Reflections as those by Miegel (2014) may be taken to indicate that there is a turning point where greater internality is detrimental to societal well-fare. Large international panel surveys, such as the

[2]Mirowsky and Ross (1990a) provide an interesting reflection on why sociologists may be motivated to rescue the theory: "Perhaps researchers studying stratification or development do not want to blame the victim by suggesting that people are poor because they are fatalistic and countries are underdeveloped because their populaces are fatalistic. To say so would suggest that the poor need only buck themselves up and get to it, and they will no longer be poor. All they have to do is convince themselves they are the masters of their fates, take responsibility, take action, and their problems will dissolve. Whatever truth there might be to this, it has the unpalatable connotation that poverty is merely the consequence of a bad attitude, which in turn is entirely optional, being a matter of choice or at most a matter of enlightenment. The assertion that fatalism is comforting if opportunities and resources are scarce portrays fatalism as a rational consequence of low status or underdevelopment. To the extent that fatalism is self-fulfilling, reducing frustration and self-blame at the cost of undermining the motivation for actions that could be successful, the assertion provides an additional theoretical tool. It implies a deviation-amplifying system that reinforces and expands socio-economic differences" (Mirowsky and Ross, 1990a, 1508).

European Values Survey, the World-Values Survey or the European Social Survey could be combined with country level indicators of economic development and social well-fare to test whether there is such a societal threshold of internality. Societal well-fare could be measured in different ways, including pure economic well-fare, indicators of social cohesion, or suicide rates. Excluding reverse-causation and alternative explanations would have to be carefully addressed in the research design, however.

The mediation analyses in the first empirical chapter revealed that status attainment in mid-adulthood is significantly related to childhood locus of control. The theory argues, however, that advantages from internal and disadvantages from external control beliefs may accumulate over the life-course. Thus it would be interesting to investigate the joint development of locus of control and social status in a dynamic framework over the life-course. Testing this proposition required a longitudinal approach with repeated measurements of locus of control and social status across the life-course. Evidence on the cumulative effects of initial locus of control would be a valuable extension to the sociological literature on locus of control.

The Twin Chapter provided some suggestive evidence that genetic risk factors for external as well as internal locus of control may be socially triggered. Social triggering could for example be identified using multivariate genetic analyses, which incorporate environmental predictors in to variance-decomposition models Plomin and Daniels (2011). Another approach two analyze this type of gene-environment interaction might be provided by the modified twin-correlation model (Turkheimer et al., 2017). Behavior-genetic evidence on locus of control is still relatively scarce, in general. The low rank-order and mean-level stability of locus of control across the life-course suggest that the contribution of genetic and different types of social factors to locus of control may also change across the life-course. Further evidence from twin and adoption studies on all age groups is needed to gain a full understanding of the dependence of locus of control on different types of social factors across the life-course. This may provide relevant information for designing effective intervention programs targeted at locus of control. This could be complemented with evidence on the effectiveness of locus of control interventions at different points in the life-course. Together these research programs may provide relevant information on sensitive periods in the development of locus of control.

Existing behavior-genetic evidence on locus of control reveals that contextual factors outside the family may play a greater role in the determination of locus of control than what the current empirical literature (which mostly focuses on determination of locus of control within the family) may suggest. The lack of evidence may be due to a scarcity of data-sets that include contextual factors. In order to determine the contextual effects on locus of control data-sets that include information from multiple social contexts, including the family but also other contexts such as schools, employers, peer networks, and neighborhoods are necessary. As the OECD (2021) points out, nationally comparative information is necessary to assess the influence of educational policies and social security policies on the development of socio-emotional skills. The SESS study by the OECD will provide a useful step towards this goal.

Furnham's (1993) reflections on the potential societal consequences of increasing internality (i.e., decreased willingness for redistribution), strengthen the case for sociological research that is concerned with the influence of genetic, familial, structural and institutional effects on individual outcomes. It is crucial that the results of this research are transmitted into the general public where it can inform public discourse on questions of redistributive justice and fair equality of opportunity.

Appendix A

The contribution of locus of control to status reproduction

Figure A.1: CARALOC Questionnaire

1. k075 **Do you feel that most of the time it's not worth trying hard because things never turn out right anyway? (LoC1)**
2. k076 Do you feel that wishing can make good things happen? (excluded)
3. k077 Are people good to you no matter how you act towards them? (excluded)
4. k078 Do you like taking part in plays or concerts? (filler item)
5. k079 **Do you usually feel that it's almost useless to try in school because most children are cleverer than you? (LoC2)**
6. k080 **Is a high mark just a matter of 'luck' for you? (LoC3)**
7. k081 Are you good at spelling? (filler item)
8. k082 **Are tests just a lot of guess work for you? (LoC4)**
9. k083 Are you often blamed for things which just aren't your fault? (excluded)
10. k084 Are you the kind of person who believes that planning ahead makes things turn out better? (inverse-coded) (excluded)
11. k085 Do you find it easy to get up in the morning? (filler item)
12. k086 When bad things happen to you, is it usually someone else's fault? (excluded)
13. k087 **When someone is very angry with you, is it impossible to make him your friend again? (LoC5)**
14. k088 **When nice things happen to you is it only good luck? (LoC6)**
15. k089 Do you feel sad when it's time to leave school each day? (excluded)
16. k090 When you get into an argument is it usually the other person's fault? (excluded)
17. k091 **Are you surprised when your teacher says you've done well? (LoC7)**
18. k092 **Do you usually get low marks, even when you study hard? (LoC8)**
19. k093 Do you like to read books? (filler item)
20. k094 **Do you think studying for tests is a waste of time? (LoC9)**

CARALOC Questionnaire, developed by Gammage (1975).

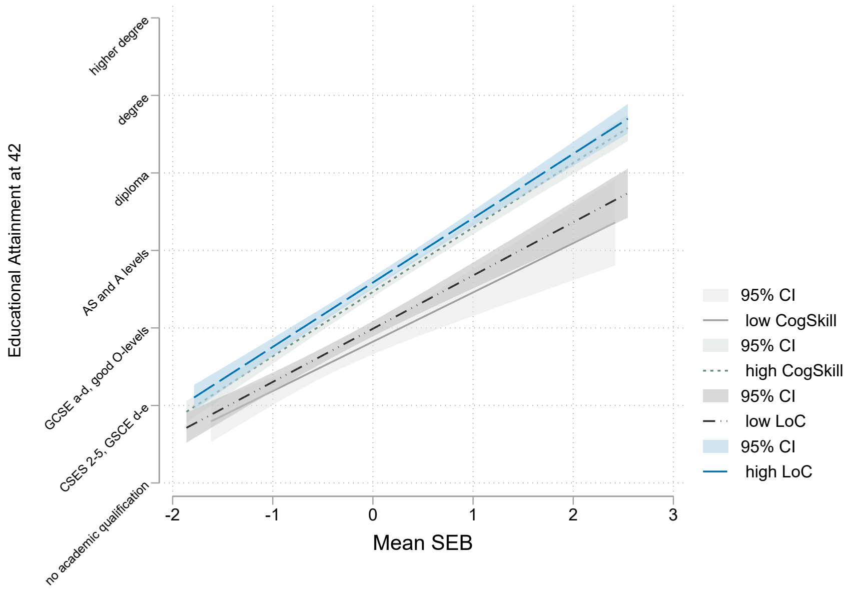
Table A.1: Items used in the measurement of SES and SEB

	Indicator Items	Scale	Description	Orig Scale	Variable	Age
SEB	Mothers and Fathers highest educational qualification	0	0 no quals	0	e189a, e189b	5
		1	1 vocational qualification	1		
		2	2 0 level or equivalent	2		
		3	3 A Level or equivalent + 4 SRN	3, 4		5
		4	5 Certificate of Education, 6 Degree level and higher	5, 6		
	Classification of Fathers and Mothers Occupation	7	Professionals, Employers and Managers of large establishments	11, 12,30, 40	back10p, back20p	10
	(Socio-Economic Group Definition)	6	Managers of small establishements, intermediate non-manual workers	22, 51		
		5	Junior non-manual workers	52, 60		
		4	Self-employed persons and own account workers	21, 120, 130, 140		
		3	Foreman and Supervisors (manual)	80		
		2	Skilled manual workers	90		
		1	Unskilled manual workers	70, 100, 110,150		
	Classification of Fathers and Mothers Occupation	6	I Professional	1	e206, e197	5
	(Social Class Definition)	5	II Managerial and Technical	2		
		4	IIIn Non-Manual Skilled	3.1		
		3	IIIm Manual skilled	3.2		
		2	IV Partially Skilled	4		
		1	V Unskilled	5		
	Gross weekly family income (c9.1 to c9.8)		7 less than 35		BD3INC	10
			6 35 - 49			
			5 50 - 99			
			4 100 - 149			
			3 150 - 199			
			2 200 - 249			
			1 250 +			
SES						
	Highest level of education attained	0	no academic qualification	0	BD9HACHQ	42
		1	cses2-5, other scottish quals and gcse d-e	1, 2		
		2	gcse a-c, good o levels scot standards	3		
		3	as levels or 1 a level	4		
		4	2+ a levels, scot higher/6th	5		
		5	diploma	6		
		6	degree level	7		
	Highest level of Academic Qualification	1	none	1	BD9HANVQ	42
	(NVQ Definition)	2	nvq level 1	2		
		3	nvq level 2	3		
		4	nvq level 3	4		
		5	nvq level 4	5		
		6	nvq level 5	6		
	Social Class of current job	6	I Professional		**B9CSC**	42
		5	II Managerial and Technical			
		4	IIIn Non-Manual Skilled			
		3	IIIm Manual skilled			
		2	IV Partially Skilled			
		1	V Unskilled			
	Classification of Occupation	7	Higher managerial and professional	1	B9CNS8	42
	(NS-SEC Definition)	6	Lower managerial and professional	2		
		5	Intermediate occupations	3		
		4	Small employers and own account workers	4		
		3	Lower supervisory and technical	5		
		2	Semi-routine occupations	6		
		1	Routine occupations	7		
		.	Never worked and long-term unemployed	8		
	Classification of Occupation	7	Professionals, Employers and Managers of large establishments	1.1, 1.2, 3, 4	B9CSEG	10
	(Socio-Economic Group Definition)	6	Managers of small establishements, intermediate non-manual workers	2.2, 5.1		
		5	Junior non-manual workers	5.2 6		
		4	Self-employed persons and own account workers	2.1, 12, 13, 14		
		3	Foreman and Supervisors (manual)	8		
		2	Skilled manual workers	9		
		1	Unskilled manual workers	7, 10, 11,15		
	Total take home household income		Less than 1,000		B9TTNCNP	42
			1,000 less than 1,600 a year			
			1,600 less than 2,100 a year			
			2,100 less than 3,400 a year			
			3,400 less than 4,800 a year			
			4,800 less than 5,800 a year			
			5,800 less than 9,200 a year			
			9,200 less than 11,900 a year			
			11,900 less than 14,000 a year			
			14,000 less than 16,200 a year			
			16,200 less than 18,500 a year			
			18,500 less than 21,300 a year			
			21,300 less than 25,600 a year			
			25,600 less than 28,400 a year			
			28,400 less than 32,400 a year			
			32,400 less than 41,400 a year			
			41,400 less than 59,800 a year			
			59,800 or more			
	hourly gross Wages (logged and centered		own calculations using the		B9GROA	42
			gross amount of pay received in a certain period		B9GROP	42
			and the number of hours worked in a typical work-week		B9CHOUR1	42

Descriptive Results - Moderation Hypothesis

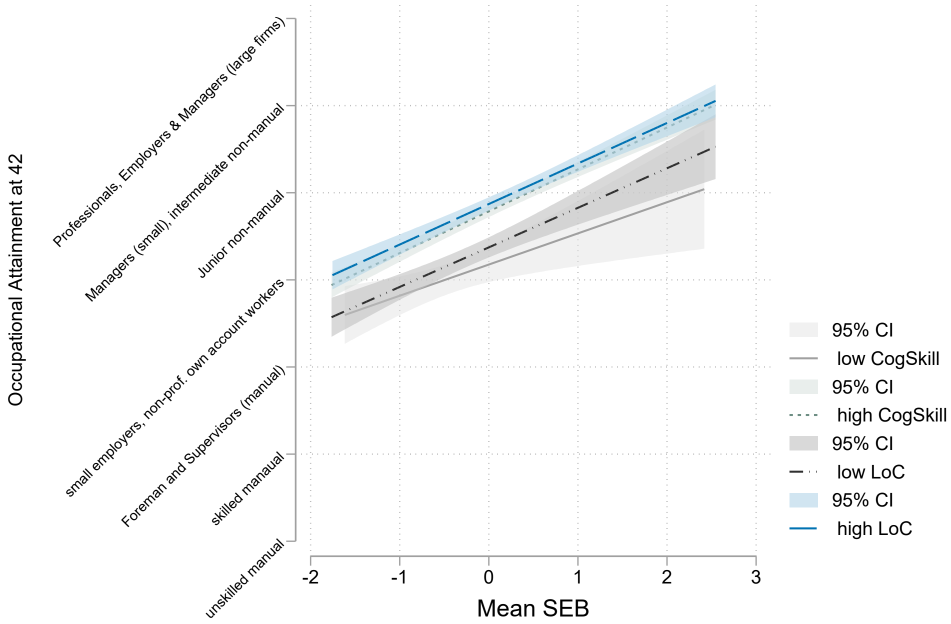
Educational attainment increases with socioeconomic background, but more so for individuals whose internal control orientation is above average. This indicates that locus of control and socio-economic background complement each other in the status attainment process. For occupational attainment the positive influence of socioeconomic background does not differ by locus of control. Locus of control and socioeconomic background appear to have independent effects. For gross hourly wages the difference between individuals with above average and below average internal locus of control orientations appears to decrease slightly as socioeconomic background increases. The negative influence of having a weak internal control orientation is less strong for individuals from higher socioeconomic backgrounds. The compensatory effect is not very strong.

Figure A.2: Educational attainment over SEB for high and low internal Locus of Control



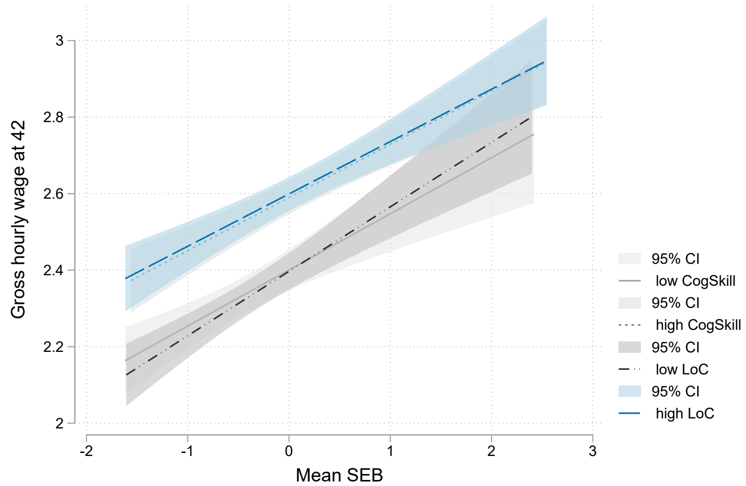
Note: The figure shows mean educational attainment by 42 over the range of socioeconomic backgrounds for high and low internal locus of control and high and low cognitive skills; Individuals with an internal locus of control / cognitive skills above the mean (0) are categorized as high, individuals with locus of control / cognitive skills below the mean are categorized as low.
Source: Own calculations based on BCS1970, weighted.

Figure A.3: Occupational attainment over SEB for high and low internal Locus of Control



Note: The figure shows mean occupational attainment by 42 over the range of socioeconomic backgrounds for high and low internal locus of control and high and low cognitive skills; Individuals with an internal locus of control / cognitive skills above the mean (0) are categorized as high, individuals with locus of control / cognitive skills below the mean are categorized as low.
Source: Own calculations based on BCS1970, weighted.

Figure A.4: Gross hourly wage over SEB for high and low internal Locus of Control



Note: The figure shows mean gross hourly wages at 42 over the range of socioeconomic backgrounds for high and low internal locus of control and high and low cognitive skills; Individuals with an internal locus of control / cognitive skills above the mean (0) are categorized as high, individuals with locus of control / cognitive skills below the mean are categorized as low.
Source: Own calculations based on BCS1970, weighted.

Table A.2: Decomposition of the total effect of socio-economic background

	Socio-Economic Background					
	Education		Income		Occupational Status	
	est.	se	est.	se	est.	se
Total	0.439***	0.011	0.330***	0.020	0.341***	0.013
Total indirect	0.180***	0.008	0.203***	0.014	0.238***	0.010
Specific indirect						
via Education			0.071***	0.006	0.072***	0.005
via LoC	0.040***	0.008	0.038**	0.013	0.040**	0.008
via Cog Skill	0.140***	0.010	0.045*	0.017	0.076***	0.011
via Education and LoC			0.011***	0.002	0.011***	0.002
via Education and Cog Skill			0.040***	0.004	0.039***	0.003
Direct	0.259***	0.014	0.127***	0.027	0.103***	0.017

Note: The table shows the decomposition of the total effect of socio-economic background the respective outcomes into its direct and (specific) indirect components, based on the mediation model (1st column in Table 6.7); Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$;
Source: Own calculations based on BCS70

Table A.3: Decomposition of the total effect of locus of control

	Locus of Control			
	Income		Occupational Status	
	est.	se	est.	se
Total	0.126***	0.034	0.093***	0.022
Total indirect	0.028***	0.006	0.029***	0.006
Specific indirect				
via Education	0.028***	0.006	0.029***	0.006
Direct	0.098**	0.034	0.064**	0.021

The table shows the decomposition of the total effect of locus of control the respective outcomes into its direct and (specific) indirect components, based on the mediation model (1st column in Table 6.7).
Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$;
Source: Own calculations based on BCS70.

Table A.4: Decomposition of the total effect of cognitive skill

	Cognitive Skill			
	Income		Occupational Status	
	est.	se	est.	se
Total	0.159***	0.032	0.182***	0.021
Total indirect	0.073***	0.007	0.038***	0.006
Specific indirect				
via Education	0.073***	0.007	0.038***	0.006
Direct	0.086*	0.033	0.144***	0.020

The table shows the decomposition of the total effect of cognitive skill the respective outcomes into its direct and (specific) indirect components, based on the mediation model (1st column in Table 6.7).
Significance levels: *** p < 0.001; ** p < 0.01; * p < 0.05
Source: Own calculations based on BCS70.

Table A.6: Structural model results for sensitivity checks

	Model 1		Model 2		Model 3	
Alternative	**Education**		**Occ Status**		**Occ Status**	
Definition	**= NVQ**		**= NS-SEC**		**= SC**	
Goodness of Fit Statistics						
Method	UPI		UPI		UPI	
OBS	8767		8767		8903	
df	142		142		108	
RMSEA	0.031		0.031		0.031	
95% CI (RMSEA)	0.030-0.031		0.030-0.031		0.029-0.032	
TLI	0.883		0.884		0.952	
CFI	0.895		0.896		0.958	
Structural model						
Locus of Control						
SEB	0.387***	0.015	0.387***	0.015	0.380***	0.015
gender	0.030*	0.014	0.029*	0.014	0.027	0.014
migr. backgr	-0.044*	0.018	-0.044*	0.018	-0.047*	0.018
single mother	-0.032*	0.016	-0.033*	0.016	-0.036*	0.016
Cognitive ability						
SEB	0.529***	0.011	0.529***	0.011	0.529***	0.012
gender	0.010	0.011	0.009	0.011	0.006	0.011
migr. backgr	-0.073***	0.015	-0.075***	0.015	-0.078***	0.015

Table A.6 – continued from previous page

	Model 1		Model 2		Model 3	
	NVQ		**NS-SEC**		**SC**	
single mother	-0.000	0.012	-0.001	0.012	-0.005	0.012
Education						
SEB	0.240***	0.017	0.239***	0.017	0.236***	0.018
Cognitive Skill	0.274***	0.022	0.289***	0.022	0.288***	0.023
Locus of Control	0.099***	0.025	0.103***	0.025	0.106***	0.028
SEB*LOC	0.024	0.490	0.027	0.034	0.027	0.039
SEB*Cogn	0.010	0.027	0.038	0.027	0.038	0.030
gender	-0.065***	0.010	-0.057***	0.010	-0.059***	0.010
migr. backgr	0.087***	0.012	0.091***	0.013	0.088***	0.016
single mother	-0.024*	0.011	-0.021	0.011	-0.021	0.011
hourly Wages (logged)						
SEB	0.168***	0.029	0.162***	0.028	0.167***	0.030
Cognitive Skill	0.081*	0.039	0.068	0.039	0.056	0.040
Locus of Control	0.106*	0.041	0.111***	0.041	0.121**	0.045
SEB*LOC	-0.011	0.056	-0.013	0.055	0.008	0.061
SEB*Cogn	0.014	0.047	0.000	0.047	-0.017	0.050
Education	0.245***	0.022	0.268***	0.022	0.277***	0.023
gender	0.315***	0.016	0.302**	0.016	0.293***	0.016
migr. backgr	0.074**	0.022	0.067**	0.021	0.073**	0.022
single mother	-0.018	0.018	-0.018	0.017	-0.026	0.018
Occ Status						
SEB	0.125***	0.018	0.126***	0.018	0.138***	0.020
Cognitive Skill	0.130***	0.023	0.135***	0.023	0.096***	
Locus of Control	0.099***	0.026	0.103***	0.026	0.091**	0.029
SEB*LOC	0.019	0.036	0.010	0.035	0.018	0.041
SEB*Cogn	-0.040	0.029	-0.068*	0.028	-0.056^{+}	0.033
Education	0.263***	0.013	0.294***	0.012	0.292***	0.013
gender	0.004	0.011	0.017	0.010	-0.005	0.011
migr. backgr	0.074***	0.012	0.061***	0.012	0.066***	0.013
single mother	-0.003	0.013	-0.002	0.012	-0.026	0.018
Intercepts						

Table A.6 – continued from previous page

	Model 1		Model 2		Model 3	
	NVQ		**NS-SEC**		**SC**	
Education	1.263***	0.015	1.179***	0.014	1.184***	0.014 5
Wages	3.930***	0.081	3.906***	0.080	3.913***	0.081
Occ Status	2.068***	0.033	2.103***	0.022	2.917***	0.037
Correlations						
LoC with Cog Skills	0.583***	0.014	0.583***	0.014	0.586***	0.014
Wage with Occ Status	0.308***	0.017	-0.376***	0.018	0.319***	0.019
R2						
houlry Wages	0.318***	0.018	0.319***	0.018	0.322***	0.018
Occ Status	0.235***	0.010	0.276***	0.010	0.242***	0.010
Education	0.274***	0.010	0.292***	0.010	0.291***	0.010
Locus of Control	0.154***	0.011	0.154***	0.011	0.149***	0.012
Cognitive Skill	0.285***	0.012	0.286***	0.012	0.286***	0.012

Note: The table shows the estimation results for the structural model part of the model when alternative definitions education and occupational status are used and when additional control variables are included. Model 1 shows the results when the National Vocational Qualification Level based on academic attainment (BD9HANVQ) is used to measure educational attainment. Results are very similar to those of the main model. One important difference is, however, that the interaction effect of cognitive skill and social background is no longer significant for occupational attainment. Model 2 presents the results when the NS-SEC indicator is used to measure Occupational status. Results are very similar to those of the main model. Model 3 uses Social Class (SC) as an indicator of occupational status and also provides results which are very close to those of the main model. Model 4 includes a measure of childhood behavioural problems as an additional covariate into the pure mediation model. The coefficients for locus of control remain significant.

Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Source: Own calculations based on BCS70.

Table A.5: Structural Component of the SEM Model without additional controls

	Mediation		**Moderation**		**Full model**	
Goodness of Fit Statistics						
Observations	8903		8903		8903	
estimated parameters	104		109		132	
RMSEA	0.031		0.035		0.032	
95% CI (RMSEA)	0.030 - 0.032		0.034 - 0.036		0.031 - 0.033	
TLI	0.951		0.892		0.885	
CFI	0.958		0.903		0.897	
Structural model						
Locus of Control						
SEB	0.392***	0.015	0.390***	0.015	0.390***	0.015
gender	0.047**	0.014	0.032*	0.014	0.033*	0.014
Cognitive ability						
SEB	0.531***	0.011	0.529***	0.011	0.529***	0.012
gender	0.017	0.013	0.011	0.012	0.012	0.011
Education						
SEB	0.263***	0.014	0.248***	0.018	0.244***	0.017
Cognitive Skill	0.262***	0.018	0.272***	0.019	0.287***	0.021
Locus of Control	0.098***	0.020	0.107***	0.022	0.094***	0.025
SEB*LOC			0.052*	0.022	0.019	0.035
SEB*Cogn					0.048	0.027
gender	-0.062***	0.010	-0.058***	0.010	-0.058***	0.010
hourly Wages (logged)						
SEB	0.128***	0.027	0.162***	0.029	0.162***	0.026
Cognitive Skill	0.076*	0.033	0.056^{+}	0.033	0.060	0.044
Locus of Control	0.097**	0.034	0.107*	0.037	0.105*	0.047
SEB*LOC			-0.003	0.038	-0.007	0.056
SEB*Cogn					0.007	0.047
Education	0.281***	0.015	0.279***	0.022	0.278***	0.022
gender	0.330***	0.017	0.315***	0.016	0.314***	0.016
Occ Status						
SEB	0.107***	0.017	0.115***	0.019	0.122***	0.018
Cognitive Skill	0.129***	0.020	0.121***	0.021	0.107***	0.023
Locus of Control	0.063**	0.021	0.078**	0.024	0.088**	0.026
SEB*LOC			-0.012	0.024	0.015	0.037
SEB*Cogn					-0.043	0.029
Education	0.286***	0.013	0.287***	0.012	0.288***	0.012
gender	0.001	0.011	0.005	0.011	0.005	0.011
Intercepts						
Education	1.186***	0.025	1.185***	0.014	1.185***	0.014
Wages	3.847***	0.071	3.931***	0.080	3.931***	0.080
Occ Status	2.126***	0.032	2.080***	0.032	2.077***	0.032
Correlations						
LoC with Cog Skills	0.575***	0.013	0.581***	0.014	0.581***	0.014
Wage with Occ Status			0.310***	0.017	0.311***	0.017
R2						
Wages	0.315***	0.015	0.319***	0.018	0.320***	0.018
Occ Status	0.219***	0.010	0.229***	0.009	0.230***	0.009
Education	0.277***	0.011	0.283***	0.010	0.285***	0.010
LoC	0.156***	0.012	0.153***	0.011	0.153***	0.011
Cogn	0.282***	0.012	0.200***	0.012	0.200***	0.012

Note: The table shows standardized weighted results for the moderation model. The first column in each model represent standardized coefficient estimates, while the second column contains the standard errors. Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{+}$ $p < 0.10$
Source: Own calculations based on BCS70.

Appendix B

Genetic determinants of locus of control

Methods of molecular Genetics

Candidate gene studies, are usually based on specific hypothesis concerning the biological functioning of particular genetic variants of single base-pairs within the DNA (so called single-nucleotide polymophisms usually referred to as SNPs or 'snips') [1]. Candidate gene studies identify the importance of these particular genetic variants by comparing the phenotype of individuals with and without the respective candidate gene (Bratko et al., 2017). As most complex traits are determined by multiple genes, candidate gene studies have played a minor role in the research on personality like characteristics.[2]

Linkage studies, like quantitative genetics, use phenotype information from different family members jointly with genetic information to map the genes for heritable traits to their chromosome locations (Cantor, 2019). In contrast to linkage studies, GWAS does not require family information and links not only regions, but particular genetic variants to particular traits (Visscher et al., 2017). GWAS use small arrays of DNA (also called chips) that contain between 200.000 and 2.000.0000 Single Nucleotide Polymorphism (SNPs) that tag common variations across the human genome (Visscher et al., 2017) and test their as-

[1] Single-Nucleotide Polymorphisms are a variation in a single-nucleotide of a particular base-pair that is commonly found in the population. Many of these SNPs will have no effect (e.g. when they are synonymous, meaning that the swap results in a base-triplet that codes the same protein) Depending on the locus of in the genome, the change of a single nucleotide may, however, have an effect on the production of proteins that affects human physical functioning and behavior.

[2] In a meta-analysis of candidate gene studies for personality Munafò et al. (2003) could not find any study that had successfully identified a single gene with a significant effect on personality.

sociation with certain genotypic differences. In contrast to candidate gene studies, linkage analysis andGenome Wide Association Study (GWAS) do not depend on particular functional hypotheses, and thus can identify genes that uncover previously unknown biological pathways (McCarthy and Hirschhorn, 2008; Visscher et al., 2012). “One unambiguous conclusion from GWASs is that for almost any complex trait that has been studied, many loci contribute to standing genetic variation. (...) This means that, on average, the proportion of variance explained at the individual variants is small” (Visscher et al., 2017, p. 8). To adjust for multiple hypothesis testing, very large sample sizes are required. This problem is increasingly solved by creating large ‘bio-banks’, such as the UK bio-bank (Sudlow et al., 2015) and collecting summary-level GWAS results in shared hubs (Zheng et al., 2017).[3] Despite growing data-sets and rapidly decreasing costs of analysis, the amount of heritability in personality and other complex traits which is currently explained through gene loci identified in GWAS is much lower than what quantitative genetics have identified (Bratko et al., 2017; Polderman et al., 2015; Visscher et al., 2017). This phenomenon is known as “missing heritability” (Maher, 2008).[4]

[3] In a meta-analysis of GWAS studies on personality based on over 17.000 individuals **?** found two SNPs that showed genome wide associated with openness and one SNP that was associate with conscientiousness, each accounting for 0.2 percent of the variation, but the results could not be replicated in a smaller replication sample. Jo et al. (2017) used summary data from GWAS studies with up to 260.000 observations to identify genetic loci associated with the Big Five and found replicable loci for Extroversion and Neuroticism, but not for the other Big Five traits.

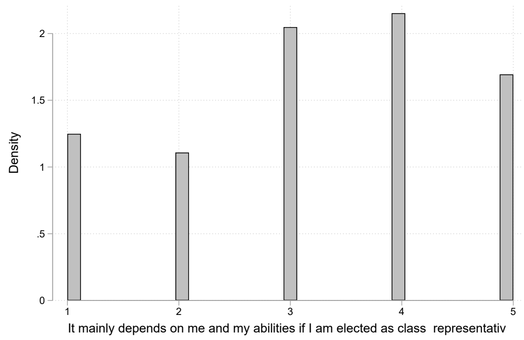
[4] To give an example: Height is known to be 80 –90 percent heritable (Maher, 2008). In 2008 Gudbjartsson et al. (2008); Lettre et al. (2008); Weedon et al. (2008) had identified 40 SNPs that jointly accounted for 5 percent of heritability. The amount of variability that can be explained by identified gene loci increases, however. By 2014, Wood et al. (2014) (cited in Visscher, 2017) had identified mover 700 SNPs which jointly explained 20 percent of heritability. Visscher et al. (2017) predicts that in the next view years this will increase to thousands of variants.

Table B.1: Two-sample t-tests

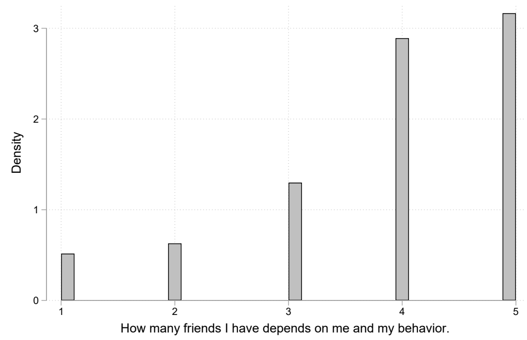
	t-statistic	degrees of freedom	p-value
Internal LoC (15-)	-1.605	569	0.109
External LoC (15-)	0.250	576	0.803
Internal LoC (16+)	-0.723	323	0.470
External LoC (16+)	0.438	329	0.661

Note: Two-sample two-tailed t-tests are performed to check whether twin pairs with full information, on whom the following analyses are based, are different from twin pairs who did not provide full information or for whom only one twin is observed. Equal variance is not assumed. In all cases, the null hypothesis of equal means cannot be rejected.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

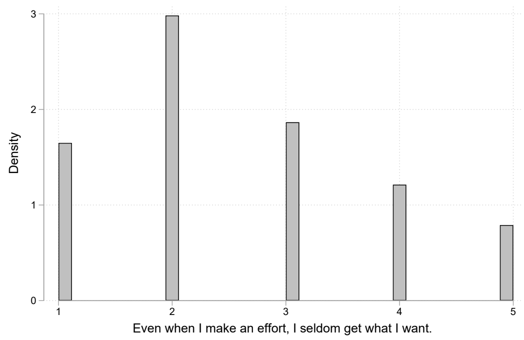
Figure B.1: Histograms of LoC Measures



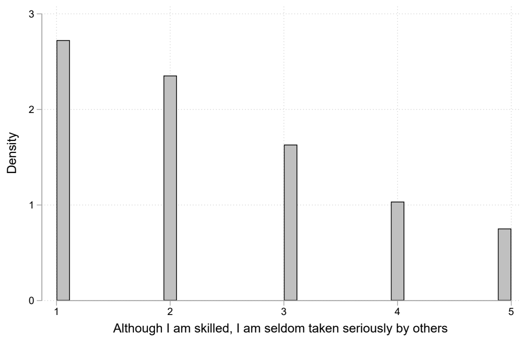
(a) loc0100: Internal LoC (15 and younger)



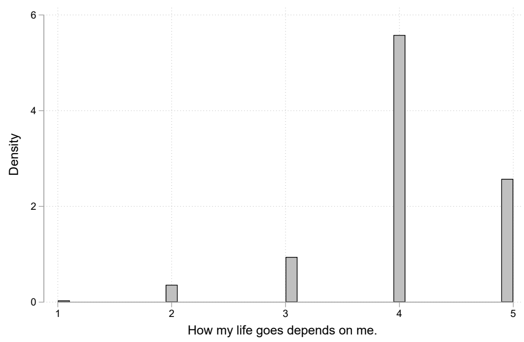
(b) loc0102: Internal LoC (15 and younger)



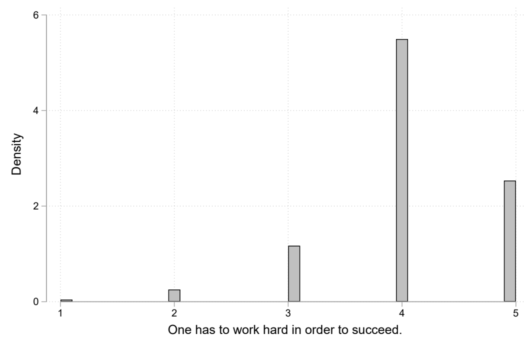
(c) loc0101: External LoC (15 and younger)



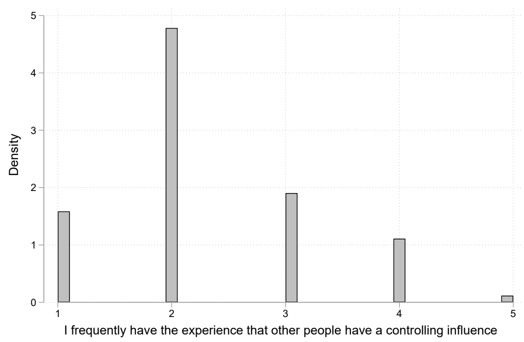
(d) loc0103: External LoC (15 and younger)



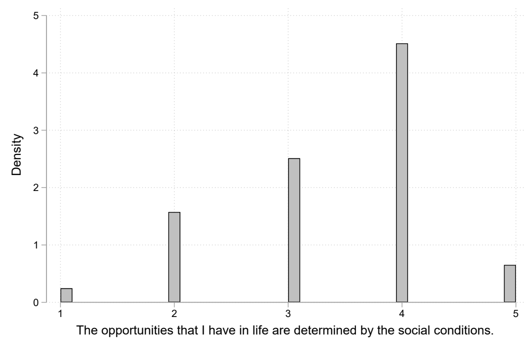
(e) loc0200: Internal LoC (16 and above)



(f) loc0202: Internal LoC (16 and above)



(g) loc0201: External LoC (16 and above)



(h) loc0203: External LoC (16 and above)

Table B.2: T-tests for descriptive statistics by subgroups

(a) **By zygosity**

	t-statistic	degrees of freedom	p-value
Internal LoC (15-)	0.426	1,373	0.670
External LoC (15-)	-0.284	1,350	0.777
Internal LoC (16+)	-0.610	1,649	0.542
External LoC (16+)	1.597	1,654	0.110

(b) **By sex**

	t-statistic	degrees of freedom	p-value
Internal LoC (15-)	1.010	1,535	0.313
External LoC (15-)	-0.170	1,536	0.865
Internal LoC (16+)	-0.073	1,462	0.942
External LoC (16+)	2.050	1,483	0.041

(c) **By parental education**

	t-statistic	degrees of freedom	p-value
Internal LoC (15-)	0.064	768	0.949
External LoC (15-)	-3.036	752	0.002
Internal LoC (16+)	-2.380	1,407	0.017
External LoC (16+)	-2.389	1,406	0.017

(d) **By parental income**

	t-statistic	degrees of freedom	p-value
Internal LoC (15-)	1.124	1,283	0.261
External LoC (15-)	-1.810	1,283	0.070
Internal LoC (16+)	-2.482	1,449	0.013
External LoC (16+)	-5.292	1,448	0.000

Note: Two-sample two-tailed t-tests are performed to check whether internal or externa locus of control differs significantly by zygosity (Panel a), sex (Panel b), parental education (Panel c), and parental income(Panel d). Equal variance is not assumed. In all cases, the null hypothesis of equal means cannot be rejected.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table B.4: Extended family correlations for male twins

internal LoC (monozygotic males)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(176)				
Twin 2	0.30***	1.00			
	(176)	(176)			
Mother	0.04	0.03	1.00		
	(156)	(156)	(297)		
Father	0.13	0.08	0.20**	1.00	
	(119)	(119)	(213)	(232)	
Sibling	-0.08	0.08	0.16	0.14	1.00
	(54)	(54)	(66)	(56)	(74)

external LoC (monozygotic males)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin_1	1.00				
	(176)				
Twin_2	0.18*	1.00			
	(176)	(176)			
Mother	0.06	0.09	1.00		
	(156)	(156)	(297)		
Father	0.19*	0.07	0.16*	1.00	
	(119)	(119)	(213)	(232)	
Sibling	0.05	0.16	-0.01	-0.21	1.00
	(54)	(54)	(66)	(56)	(74)

internal LoC (Dizygotic males)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(164)				
Twin 2	0.13	1.00			
	(164)	(164)			
Mother	0.01	-0.05	1.00		
	(148)	(148)	(376)		
Father	0.10	0.02	0.06	1.00	
	(108)	(108)	(272)	(279)	
Sibling	0.05	-0.11	0.02	0.20	1.00
	(49)	(49)	(70)	(52)	(75)

external LoC (Dizygotic males)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(164)				
Twin 2	0.16*	1.00			
	(164)	(164)			
Mother	0.12	0.03	1.00		
	(148)	(148)	(376)		
Father	0.19*	0.11	0.12	1.00	
	(108)	(108)	(272)	(279)	
Sibling	0.14	0.04	0.31**	-0.13	1.00
	(49)	(49)	(70)	(52)	(75)

Note: The table shows correlations for male twins and their family members by zygosity and gender.
Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table B.5: Extended family correlations for female twins

internal LoC (monozygotic females)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(252)				
Twin 2	0.25***	1.00			
	(252)	(252)			
Mother	0.13	0.15*	1.00		
	(208)	(208)	(373)		
Father	0.02	0.18*	0.08	1.00	
	(148)	(148)	(246)	(268)	
Sibling	0.12	0.07	0.12	0.04	1.00
	(67)	(67)	(82)	(62)	(91)

external LoC (monozygotic females)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(252)				
Twin 2	0.31***	1.00			
	(252)	(252)			
Mother	-0.07	0.04	1.00		
	(208)	(208)	(373)		
Father	-0.01	0.09	0.09	1.00	
	(148)	(148)	(246)	(268)	
Sibling	0.07	0.25*	0.03	0.19	1.00
	(67)	(67)	(82)	(62)	(91)

internal LoC (dizygotic females)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(164)				
Twin 2	0.13	1.00			
	(164)	(164)			
Mother	0.01	-0.05	1.00		
	(148)	(148)	(376)		
Father	0.10	0.02	0.06	1.00	
	(108)	(108)	(272)	(279)	
Sibling	0.05	-0.11	0.02	0.20	1.00
	(49)	(49)	(70)	(52)	(75)

external LoC (dizygotic females)

	Twin 1	Twin 2	Mother	Father	Sibling
Twin 1	1.00				
	(164)				
Twin 2	0.16*	1.00			
	(164)	(164)			
Mother	0.12	0.03	1.00		
	(148)	(148)	(376)		
Father	0.19*	0.11	0.12	1.00	
	(108)	(108)	(272)	(279)	
Sibling	0.14	0.04	0.31**	-0.13	1.00
	(49)	(49)	(70)	(52)	(75)

Note: The table shows correlations for female twins and their family members by zygosity and gender.
Significance levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table B.6: Twin Models for Children

	Internal LoC (15-)				External LoC (15-)			
Model	**CE**	**ACE**	**ADE**	**DCE**	**CE**	**ACE**	**ADE**	**DCE**
	b	b	b	b	b	b	b	b
	se	se	se	se	se	se	se	se
	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value
Components								
a		**0.186**	**0.507**			**0.375**	**0.644**	
		0.365	0.046			0.161	0.034	
		0.610	0.000			0.020	0.000	
c	**0.455**	**0.427**		**0.441**	**0.583**	**0.488**		**0.533**
	0.040	0.122		0.072	0.033	0.099		0.058
	0.000	0.000		0.000	0.000	0.000		0.000
d			**0.000**	**0.152**			**0.000**	**0.306**
			0.247	0.298			0.204	0.131
			0.000	0.610			1.000	0.020
e	**0.889**	**0.884**	**0.861**	**0.884**	**0.812**	**0.788**	**0.761**	**0.788**
	0.023	0.031	0.027	0.031	0.021	0.029	0.025	0.029
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
h^2		**0.035**	**0.258**	**0.023**		**0.141**	**0.418**	**0.094**
		0.136	0.044	0.091		0.120	0.038	0.080
		0.799	0.000	0.799		0.243	0.000	0.244
Fit Staticists								
RMSEA	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.000
RMSEA CI	0.000 0.000	0.000 0.000	0.000 0.060	0.000 0.000	0.000 0.055	0.000 0.054	0.000 0.092	0.000 0.054
SRMR	0.016	0.015	0.030	0.015	0.042	0.037	0.048	
CFI	1.000	1.000	1.000	1.000	1.000	1.000	0.959	1.000
TLI	1.056	1.055	1.017	1.055	1.006	1.008	0.983	1.008
LL (H0)	-2167.086	-2167.054	-2168.571	-2167.054	-2137.310	-2136.638	-2139.571	-2136.638
LL (H1)	-2166.756	-2166.756	-2166.756	-2166.756	-2137.310	-2135.126	-2135.126	-2135.126
df	6	5	5	5	6	5	5	5
χ^2	0.660	0.595	3.629	0.595	4.369	3.024	8.891	3.024
p-value	0.995	0.988	0.604	0.988	0.627	0.696	0.114	0.696
Twin Pairs								
MZ	322				322			
DZ	448				448			

Note: The table shows the estimation results for the classic and modified twin models for the younger two cohorts. lower-case letters indicate path coefficients; path coefficients need to be squared to yield the respective component; a = additive genetic; d = dominant genetic; c = shared-environmental; e = non-shared environment; h^2 = total heritability.
Source: Own calculations based on TwinLife V.3.0 and F2F2 pre-release version.

Table B.7: Twin Models for Young Adults

		Internal LoC (16+)					**External LoC (16+)**				
Model	**AE**	**ACE**	**ADE**	**DCE**	**Ext. Tw.**		**ACE**	**ADE**	**DCE**	**Ext. Tw.**	
		b	b	b	b	b		b	b	b	b
		se	se	se	se	se		se	se	se	se
		p-value	p-value	p-value	p-value	p-value		p-value	p-value	p-value	p-value
Components											
	a	**0.515**	**0.515**	**0.417**		**0.385**		**0.435**	**0.525**		**0.403**
		0.043	0.043	0.236		0.073		0.149	0.041		0.069
		0.000	0.000	0.077		0.000		0.003	0.000		0.000
	c		**0.000**		**0.241**			**0.273**		**0.371**	
			0.332		0.136			0.192		0.089	
			0.999		0.077			0.156		0.000	
	d			**0.316**	**0.468**	**0.001**			**0.000**	**0.355**	**0.000**
				0.335	0.102	2.092			0.386	0.122	0.596
				0.346	0.000	1.000			1.000	0.003	1.000
	e	**0.857**	**0.857**	**0.852**	**0.852**	**0.892**		**0.857**	**0.850**	**0.857**	**0.884**
		0.026	0.026	0.028	0.028	0.020		0.027	0.025	0.027	0.020
		0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
	t					**0.189**					**0.220**
						0.156					0.140
						0.226					0.116
	x					**0.000**					**0.005**
						0.001					0.006
						1.000					0.476
	w					**0.003**					**-0.020**
						0.015					0.016
						0.837					0.220
	μ					**0.000**					**0.138**
						0.001					0.007
						0.920					0.000
	m					**0.007**					**-0.045**
						0.033					0.032
						0.841					0.154
	q					**1.026**					**1.021**
						0.009					0.006
						0.000					0.000
	h^2					**0.154**		0.189	0.276	0.126	**0.169**
						0.060		0.129	0.040	0.086	0.058
						0.010		0.142	0.000	0.142	0.004
	σ^2					**0.986**					**0.984**
						0.025					0.025
	^{2}					0.000					0.000
Fit Staticists											
	RMSEA	0.047	0.056	0.055	0.066	0.017		0.000	0.000	0	0.027
	RMSEA CI	0.000 0.088	0.010 0.099	0.007 0.098	0.022 0.113	0.000 0.044		0.000 0.058	0.000 0.062	0.000 0.058	0.000 0.050
	SRMR	0.052	0.052	0.052	0.052	0.057		0.036	0.038	0.036	0.073
	CFI	0.850	0.823	0.829	0.802	0.947		1.000	1.000	1	0.864
	TLI	0.950	0.929	0.932	0.901	0.959		1.013	1.008	1.013	0.896
	LogLikelyhood	-2339.075	-2339.075	-2338.963	-2338.959	-4354.284		-2336.036	-2336.285	-2336.036	-4357.882
		-2333.311	-2333.311	-2333.311	-2333.311	-4339.716		-2334.196	-2334.196	-2334.196	-4340.823
	df	6	5	5	5	26		5	5	5	26
	χ^2 Test	11.527	11.527	11.304	11.295	29.135		3.680	4.178	3.68	34.119
		0.073	0.042	0.046	0.023	0.305		0.596	0.524	0.5963	0.132
Twin Pairs											
	MZ			428					428		
	DZ			403					403		

Note: The table shows the estimation results for the classic, modified and extended twin models for the older two cohorts. lower-case letters indicate path coefficients; path coefficients need to be squared to yield the respective component; a = additive genetic ; d = dominant genetic factor; f = environmental factors common to all family members; t = twin-specific factor shared among siblings; e = unique environmental factors; h^2 total heritability; x = variance of f^2; q = Variance of a^2 adjusted for assortative mating, w = covariance among f^2 and a^2, μ = assortative mating, m = vertical cultural transmission, h^2 = total heritability, σ^2 = estimated variance of observed variable.
Source: Own calculations based on TwinLife V.3.0 andF2F2 pre-release version.

Appendix C

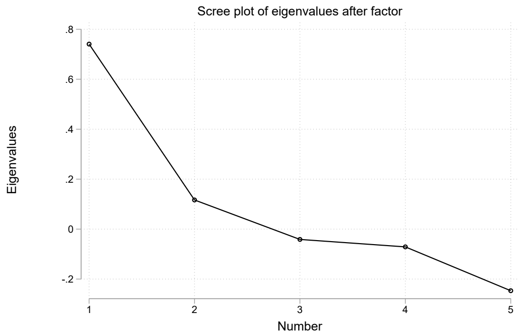
Effects of low-intensity mentoring on locus of control

Table C.1: Question Wording and Alpha Levels for LoC Measures in the briq Family Panel

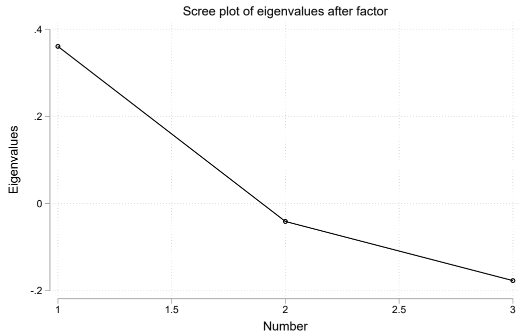
	Wave										
Question Wording (in German)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**varname**	**Dim**	**source (item)**
Do you believe that if somebody studies hard enough he or she can pass any subject. (Man kann durch ganz viel Lernen in jedem Fach in der Schule gut sein.)	x	x	x	x	x				frabo_01	IS	CNS-IE (6)
When you get punsihed does it usually seem its for no good reason at all? (Ich bekomme Ärger für Sachen, für die ich eigentlich gar nichts kann.)	x	x	x						frabo_02	P	CNS-IE (11)
Do you feel that one of the best ways to handle most problems is just not to think about them? (Man kommt mit den meisten Problemen am besten klar, wenn man nicht darüber nachdenkt.)	x	x	x						frabo_03	I	CNS-IE (19)
Do you feel that most of the time parents listen to what their children have to say? (Eltern hören sich das an, was ihre Kinder zu sagen haben.)	x	x	x						frabo_04	P	CNS-IE (9)
Do you usually feel that it's almost useless to try in school because (...)? (Ich habe oft das Gefühl, dass es sich gar nicht lohnt, wenn ich mich in der Schule anstrenge (...))	x	x	x						frabo_05	IS	CNS-IE (37)
When I have a goal, I work hard to achieve it (Wenn ich mir etwas vornehme, arbeite ich hart um es zu erreichen.)				x	x				sc-8	I	Grit
How my life goes depends on me. (Wie mein Leben verläuft, hängt von mir selbst ab.)						x			loc_1	I	IPC-S (1)
Compared to other people, I have not achieved what I deserve. (Im Vergleich mit anderen habe ich nicht das erreicht, was ich verdient habe.)						p/m			loc_2	yes	IPC-S (2)
What a person achieves in life is above all a question of fate or luck. (Was man im Leben erreicht, ist in erster Linie eine Frage von Schicksal und Glück.)				x	x	x	x	x	loc_3	C	IPC-S (3)
I frequently have the experience that other people have a controlling influence over my life. (Ich mache häufig die Erfahrung, dass andere über mein Leben bestimmen.)						x			loc_4	P	IPC-S (5)
One has to work hard in order to succeed (Erfolg muss man sich hart erarbeiten.)						x			loc_5	I	IPC-S (6)
When I encounter difficulties in life, I often doubt my own abilities. (Wenn ich im Leben auf Schwierigkeiten stoße, zweife ich an meinen Fähigkeiten.)						x			loc_6	?	IPC-S (7)
The opportunities that I have in life are determined by the social conditions. (Welche Möglichkeiten ich im Leben habe, wird von den sozialen Umständen bestimmt.)						x			loc_7	P	IPC-S (8)
Innate abilities are more important than any efforts one can make. (Wichtiger als alle Anstrengungen sind die Fähigkeiten, die man mitbringt.)						x			loc_8	I	IPC-S (9)
I have little control over the things that happen in my life. (Ich habe wenig Kontrolle über Dinge, die in meinem Leben passieren.)						x			loc_9	I	IPC-S (10)
I'm my own boss (Ich habe mein Leben selbst in der Hand)							x	x	sbhvbip04	I	IE-4 (1)
If I work hard, I will succeed (Wenn ich mich anstrenge, werde ich auch Erfolg haben.)							x	x	sbhvbip05	I	IE-4 (2)
Fate often gets in the way of my plans. (Meine Pläne werden oft vom Schicksal durchkreuzt.)							x	x	sbhvbip06	C	IE-4 (4)
Crohnbachs alpha	**0.20**	**0.19**	**0.28**	**0.31**	**0.39**	**0.57**	**0.37**	**0.46**			

Note: The table provides an overview over the measurement constructs used to measure locus of control in different waves of the briq Family Panel together with Crohnbachs α for children for the respective item-sets in each wave (not differentiating internal and external dimensions); x means that the item was included in the children's questionnaire. p/m indicates that the respective item was additionally included in the measurement of locus of control for parents and mentors.
Source: Own calculations based on briq Family Panel waves 1 - 8.

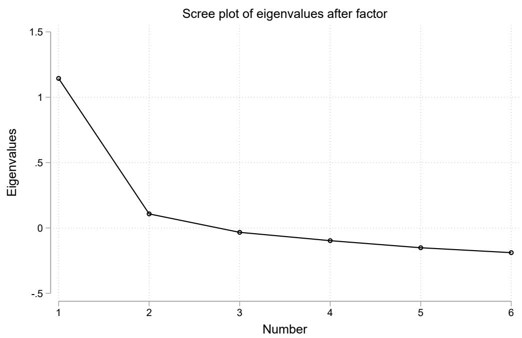
Figure C.1: Scree-Plots for Locus of control Measures



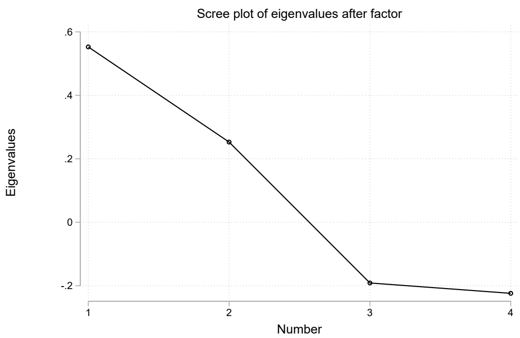
(a) Scree-Plot for Waves 1 to 3



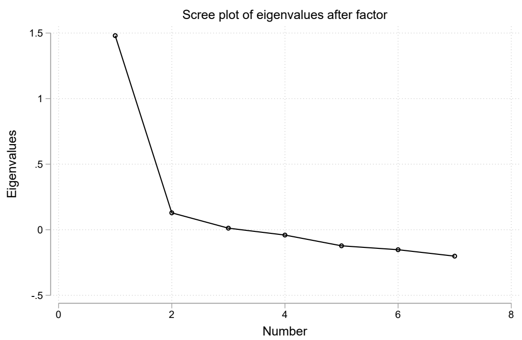
(b) Scree-Plot for Waves 4 and 5



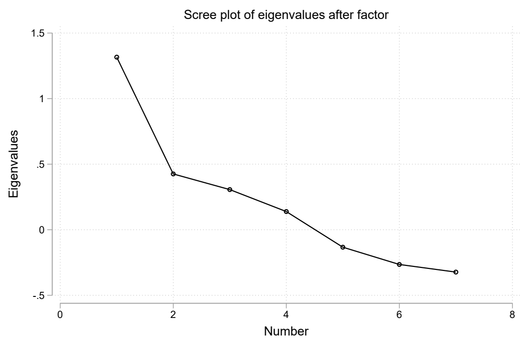
(c) Scree-Plot for Wave 6



(d) Scree-Plot for Wave 7



(e) Locus of Control - Scree-Plots for Parents



(f) Locus of Control - Scree-Plots for Mentors

Note: The figures show scree plots for the respective measurement instruments for locus of control used in the briq Family Panel. When measurement instruments were implemented in more than one wave that data were pooled across waves.
Source: Own calculations based on briq Family Panel waves 1 - 8.

Table C.2: Summary Statistics for LoC Items for Children

	count	mean	sd	min	p50	max	skewness	kurtosis
frabo_01	1879	4.188	0.963	1	4	5	-1.045	3.574
frabo_02	1878	3.364	1.353	1	3	5	-0.246	1.893
frabo_03	1879	2.846	1.418	1	3	5	0.165	1.779
frabo_04	1876	3.695	1.361	1	4	5	-0.765	2.407
frabo_05	1879	3.347	1.655	1	4	5	-0.341	1.455
frabo_01 (wave 4-5)	1015	5.595	1.593	1	6	7	-1.061	3.320
loc_3 (wave 4-5)	1013	4.428	1.834	1	4	7	-0.273	2.118
sc_8	1013	5.917	1.122	1	6	7	-1.007	3.841
loc_1	496	5.603	1.223	1	6	7	-0.812	3.617
loc_3_r	2468	4.543	1.697	1	5	7	-0.277	2.271
loc_4_r	495	5.172	1.446	1	5	7	-0.728	2.999
loc_6_r	496	4.873	1.539	1	5	7	-0.452	2.407
loc_7_r	496	4.141	1.444	1	4	7	0.143	2.713
loc_9_r	495	5.238	1.371	1	5	7	-0.836	3.523
sbhvbip04	959	3.885	0.862	1	4	5	-0.463	2.929
sbhvbip05	957	4.358	0.757	1	5	5	-1.134	4.343
sbhvbip06	950	2.628	0.957	1	3	5	0.316	2.825
loc_3 (wave 7-8)	957	5.216	1.314	1	5	7	-0.674	3.398

Note: The table provides key summary statistics for the items of the different locus of control measures for children.
Source: Own calculations based on briq Family Panel waves 1 - 8.

Table C.3: Summary Statistics for LoC Items for Parents

	count	mean	sd	min	p50	max	skewness	kurtosis
p_loc_1	710	5.541	1.417	1	6	7	-1.064	3.754
p_loc_2_r	708	5.095	1.840	1	6	7	-0.641	2.199
p_loc_3_r	711	4.658	1.763	1	5	7	-0.556	2.424
p_loc_4_r	710	5.496	1.643	1	6	7	-1.081	3.213
p_loc_6_r	708	4.597	1.771	1	5	7	-0.358	2.060
p_loc_7_r	710	3.597	1.619	1	3	7	0.370	2.413
p_loc_9_r	709	5.681	1.482	1	6	7	-1.382	4.353

Table C.4: Summary Statistics for LoC Items for Parents

	count	mean	sd	min	p50	max	skewness	kurtosis
m_loc_1	99	5.667	0.926	2	6	7	-0.922	4.752
m_loc_2_r	98	6.051	1.213	2	6	7	-1.352	4.138
m_loc_3_r	98	5.235	1.003	2	5	7	-0.544	3.582
m_loc_4_r	98	5.643	1.204	2	6	7	-0.820	2.992
m_loc_6_r	98	4.255	1.365	1	4	7	0.070	2.747
m_loc_7_r	99	3.313	1.251	1	3	6	0.178	2.601
m_loc_9_r	98	5.837	1.146	2	6	7	-1.247	4.585

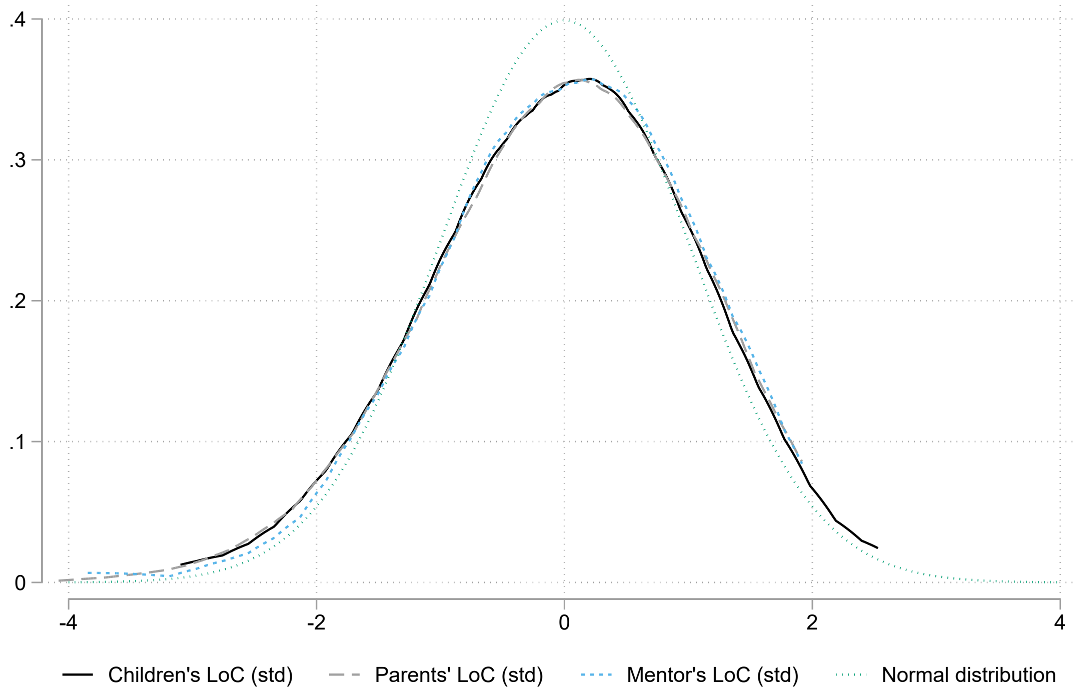
Note: Table A.3 and A.4 provide key summary statistics for the items of the locus of control measure for parents and mentors.
Source: Own calculations based on briq Family Panel wave 1.

Table C.5: Test-Retest Correlations for LoC-Items for Children

	Intra-Class Correlation
Frabo_01	0.110
Frabo_02	-0.192
Frabo_03	-0.001
Frabo_04	0.098
Frabo_05	-0.300
Frabo_01(w4-w5)	0.328
loc_3(w4-w5)	0.397
Grit_item	0.337
loc_3	0.326
sbhvbip04	0.465
sbhvbip05	0.414
sbhvbip06	0.379

Note: The table shows intra-class correlations for those items that were asked in more than one wave. The sample consists of control low-SES and control high-SES children.
Source: Own calculations based on briq Family Panel waves 1 - 8.

Figure C.2: Density plots of the respective general locus of control measures for children, parents and mentors



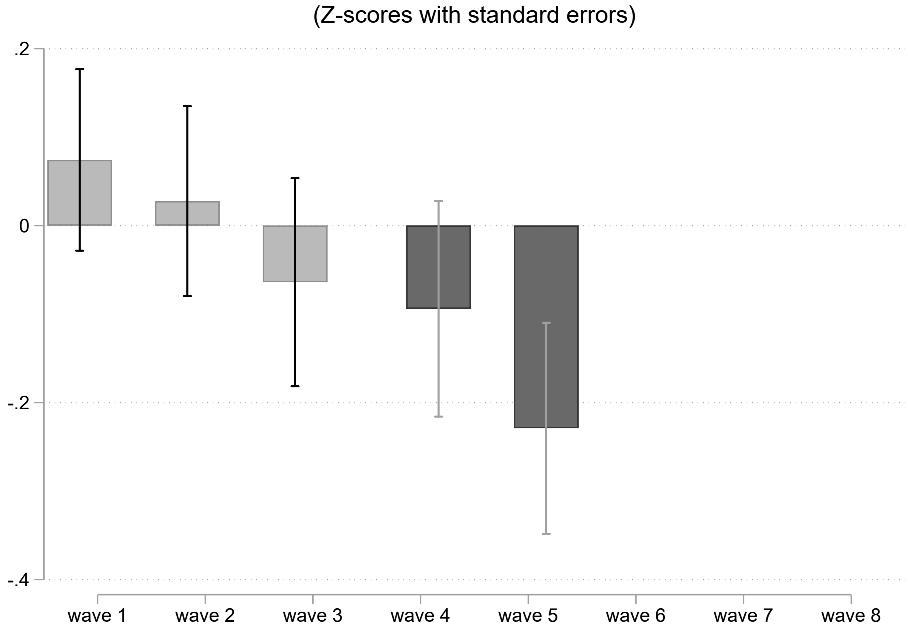
Note: The figure shows density plots for each of the final latent-score for locus of control for children, parents and mentors. Measures for parents and mentors are taken from wave 1 and include all groups. Children's measure is taken from wave 6 and includes all groups. $p < 0.001$
Source: Own illustration based on briq Family Panel waves 1 - 8.

Table C.6: Items used for dimensional and domain-specific measures of locus of control

	Items		
Waves 1, 2 and 3			
Internal (academic)	frabo_01	frabo_05 (rev)	
Internal			
Powerful Others	frabo_04		
Chance	na		
Waves 4 and 5			
Internal (academic)	frabo_01		
Internal	na		
Powerful Others	na		
Chance	loc_3		
Wave 6			
Internal	loc_1	loc_5	loc_8 (rev)
Powerful Others	loc_4	loc_7	
Chance	loc_3		
Waves 7 and 8			
Internal	sbhvbib_04	sbhvbib_05	
Powerful Others	na		
Chance	loc_3		

Note: The table provides an overview over the items used to construct dimensional and domain specific measures of locus of control in the respective waves.

Figure C.3: Mean-level differences between high and low SES children in academic locus of control



Note: The figure shows mean differences between the high SES control group and the low SES control group in the domain-specific measure of the locus of control orientation for the first five waves of the panel. Results were obtained from two-group t-tests. Error bars not crossing the 0 line indicate that the difference in means between children from the high SES control group and children from the low SES control group are significant. Bars in the same color indicate that the same set of items was used for the dimensional measure of locus of control. For wave 1-3 two items used to measure academic locus of control. These are: (frabo_01) and (frabo_05). In waves 4 and 5 only frabo_01 was used.
Source: Own illustration based on briq Family Panel waves 1 - 8.

Table C.7: Comparison of mentors' locus of control with parents' and children's locus of control

	Mean	SD	SE	95% Confidence Interval		Obs.
Internal						
Mentors	5.470	0.798	0.080	5.312	5.627	99
High SES Parents (control)	5.533	0.832	0.076	5.384	5.682	120
Low SES Parents (control)	5.659	1.094	0.046	5.569	5.748	573
High SES Children (control)	5.416	1.074	0.110	5.200	5.632	95
Low SES Children (control)	5.682	0.970	0.062	5.561	5.804	244
Powerful Others						
Mentors	3.545	1.023	0.103	3.344	3.747	99
High SES Parents (control)	3.362	1.043	0.095	3.176	3.549	120
Low SES Parents (control)	3.461	1.281	0.054	3.356	3.566	573
High SES Children (control)	3.279	0.880	0.090	3.102	3.456	95
Low SES Children (control)	3.360	1.179	0.076	3.212	3.508	243
Chance						
Mentors	2.765	1.003	0.101	2.567	2.964	98
High SES Parents (control)	2.900	1.552	0.142	2.622	3.178	120
Low SES Parents (all)	3.411	1.788	0.075	3.264	3.557	572
High SES Children (control)	2.875	1.316	0.134	2.612	3.138	96
Low SES Children (control)	3.370	1.450	0.092	3.189	3.551	246

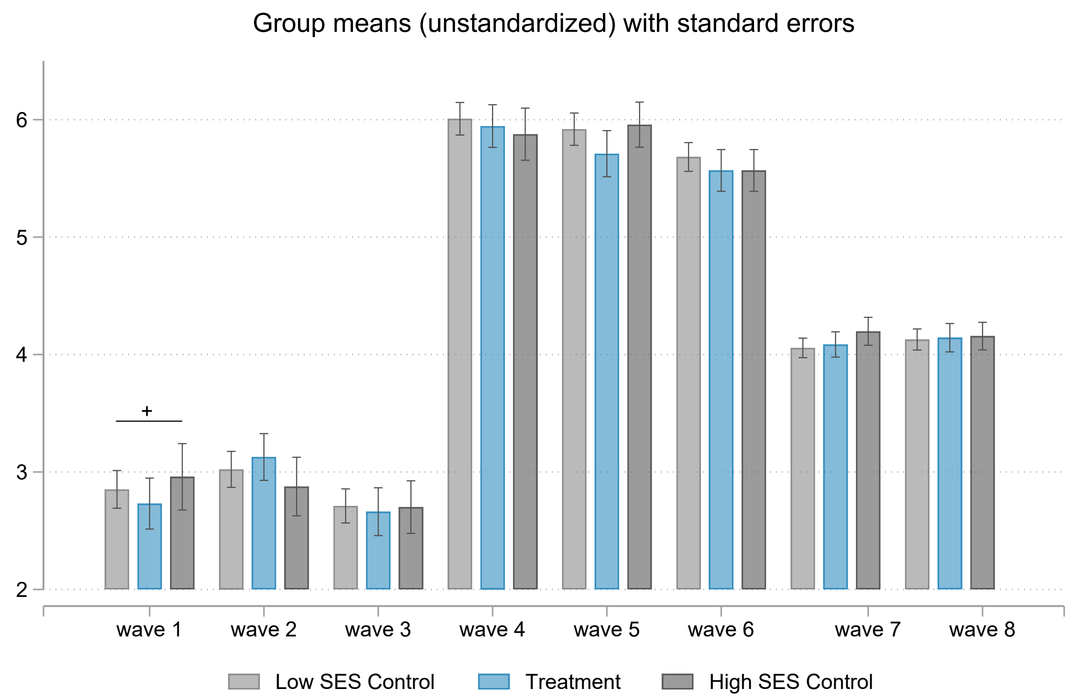
Note: The table provides group level summary statistics for mentors general and dimensional locus of control orientation as compared to the general and dimensional locus of control orientations of Parents and Children. SD: Standard Deviation; SE: Standard Error; CI: Confidence Interval; Measurements of low SES parents are based on pre-treatment measures from wave 1. Hence all parents classified as low SES were included. For children, only low SES children from the control group could be included, since the locus of control measure had to be taken from wave 6 to be comparable to parents and mentors measures.
Source: Own illustration based on briq Family Panel waves 1 - 8.

Table C.8: Results of the Post-Hoc Comparisons usings Tukey's HSD test

		Internal			**Powerful others**			**Chance**		
		L vs. T	L vs. H	T v.s H	**L vs. T**	L vs. H	T v.s H	**L vs. T**	L vs. H	T v.s H
Wave 1	Diff	-0.121	0.107	0.228	**-0.206**	-0.199	0.006			
	SE	0.136	0.165	0.181	**0.084**	0.102	0.111			
	(p-Value)	0.650	0.794	0.417	**0.039**	0.125	0.998			
Wave 2	Diff	0.105	-0.146	-0.252	0.042	-0.069	-0.110			
	SE	0.128	0.150	0.164	0.083	0.098	0.107			
	(p-Value)	0.687	0.592	0.275	0.872	0.760	0.555			
Wave 3	Diff	-0.049	-0.010	0.039	-0.117	-0.108	0.009			
	SE	0.123	0.142	0.156	0.075	0.087	0.095			
	(p-Value)	0.917	0.997	0.967	0.262	0.425	0.995			
Wave 4	Diff	-0.062	-0.131	-0.069				**-0.404**	-0.908	-0.504
	SE	0.116	0.134	0.147				**0.193**	0.221	0.244
	(p-Value)	0.854	0.588	0.885				**0.092**	0.000	0.098
Wave 5	Diff	-0.209	0.038	0.247				-0.318	-0.508	-0.191
	SE	0.116	0.132	0.146				0.186	0.213	0.235
	(p-Value)	0.169	0.954	0.207				0.203	0.046	0.696
Wave 6	Diff	-0.115	-0.267	-0.152	0.040	-0.081	-0.121	**-0.391**	-0.495	-0.104
	SE	0.108	0.123	0.135	0.120	0.137	0.151	**0.147**	0.168	0.184
	(p-Value)	0.539	0.078	0.500	0.941	0.824	0.701	**0.022**	0.009	0.840
Wave 7	Diff	0.029	0.141	0.112				**-0.415**	-0.477	-0.062
	SE	0.068	0.076	0.085				**0.153**	0.173	0.191
	(p-Value)	0.903	0.155	0.382				**0.019**	0.017	0.943
Wave 8	Diff	0.015	0.029	0.014				-0.199	-0.454	-0.256
	SE	0.074	0.084	0.093				0.169	0.194	0.214
	(p-Value)	0.977	0.936	0.988				0.469	0.051	0.459

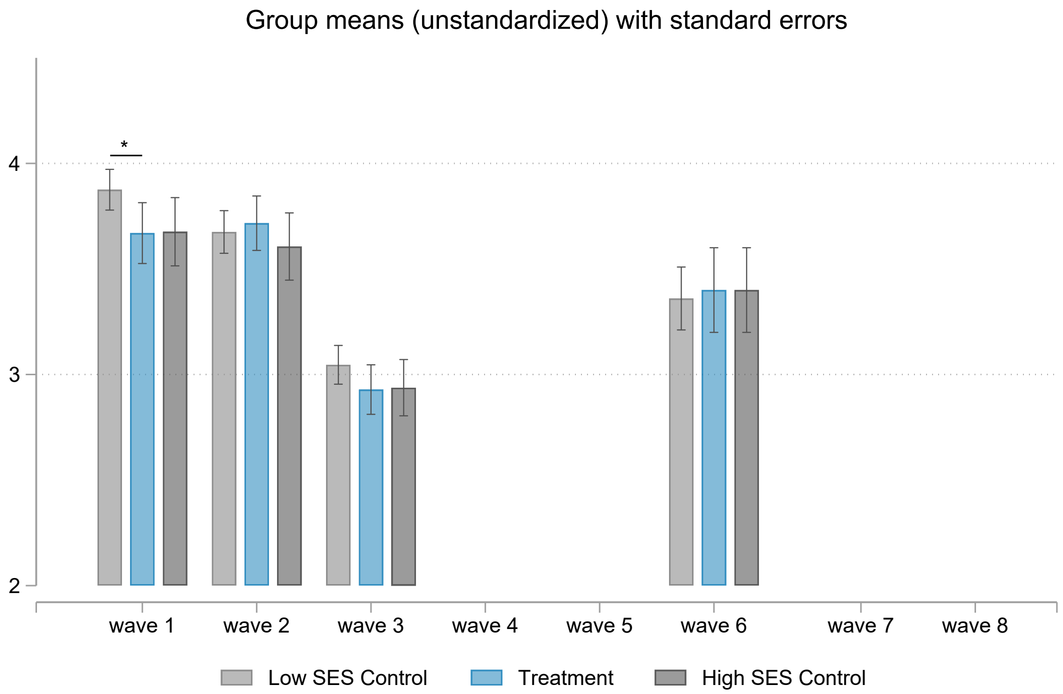
Note: The table shows the results of the post-hoc Tukey analysis for all dimensions and waves. The post-hoc analysis provides pairwise comparisons between all treatment groups. L vs. T: Low SES control vs. Treatment; L vs. H: Low SES control vs. High SES control; T vs. H: Treatment vs. High SES control; SE: Stanrdard Error.
Source: Own illustration based on briq Family Panel waves 1 - 8.

Figure C.4: Tukey's HSD test for the Internal dimension of locus of control



Note: The figure shows mean differences between the treatment group and the low SES and high SES control grousp in the Internal dimension of the locus of control orientation for all waves of the panel. Results were obtained from Anova zests, using Boneferroni correction for multiple groups and post-hoc comparisons using Tukey's HSD test. Significance of group differences is indicated above the vertical lines. Significance levels: + $p < 0.1$; * $p < 0.05$ **; $p < 0.01$; *** $p < 0.001$; The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own illustration based on briq Family Panel waves 1 - 8.

Figure C.5: Tukey's HSD test for the Powerful Others dimension of locus of control



Note: The figure shows mean differences between the treatment group and the low SES and high SES control grousp in the chance dimension of the locus of control orientation for all waves of the panel. Results were obtained from Anova zests, using Boneferroni correction for multiple groups and post-hoc comparisons using Tukey's HSD test. Significance levels: + p < 0.1; * p < 0.05 **; p < 0.01; *** p < 0.001; The specific items selected for each dimension in the respective wave can be found in Table C.6 in the Appendix.
Source: Own illustration based on briq Family Panel waves 1 - 8.

Table C.9: Complementary or compensatory effects of mentoring

	Internal Dimension							
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7	Wave 8
Treatment	-0.161	0.075	-0.061	-0.086	-0.230	-0.104	0.051	0.027
	(-1.144)	(0.580)	(-0.468)	(-0.731)	(-1.884)	(-0.959)	(0.727)	(0.350)
High SES	0.065	-0.176	-0.019	-0.150	0.019	-0.257*	0.159*	0.038
	(0.390)	(-1.158)	(-0.140)	(-1.111)	(0.152)	(-2.003)	(2.128)	(0.516)
Cologne	-0.175	-0.121	-0.051	-0.097	-0.099	0.048	0.093	0.054
	(-1.304)	(-0.989)	(-0.451)	(-0.882)	(-0.896)	(0.491)	(1.399)	(0.744)
Constant	2.994***	3.120***	2.752***	6.085***	5.998***	5.644***	3.983***	4.085***
	(22.091)	(24.985)	(24.372)	(54.301)	(54.177)	(61.103)	(57.332)	(55.490)
N	712	607	508	504	479	479	469	456

	Powerful Others Dimension				Chance Dimension				
	Wave 1	Wave 2	Wave 3	Wave 6	Wave 4	Wave 5	Wave 6	Wave 7	Wave 8
Treatment	-0.166	0.0596	-0.147	0.0578	-0.448*	-0.360	-0.392**	-0.471**	-0.214
	(-1.84)	(0.71)	(-1.90)	(0.44)	(-2.22)	(-1.90)	(-2.62)	(-3.00)	(-1.19)
High SES	-0.158	-0.0512	-0.130	-0.0656	-0.940***	-0.545**	-0.495**	-0.525**	-0.466*
	(-1.63)	(-0.53)	(-1.57)	(-0.55)	(-4.22)	(-2.60)	(-2.99)	(-3.11)	(-2.57)
Cologne	0.173*	0.0732	-0.125	0.0818	-0.176	-0.189	-0.00164	-0.245	-0.0721
	(2.03)	(0.94)	(-1.82)	(0.74)	(-0.94)	(-1.03)	(-0.01)	(-1.67)	(-0.43)
Constant	3.735***	3.616***	3.146***	3.295***	4.078***	3.852***	3.371***	3.440***	3.460***
	(43.50)	(46.32)	(44.88)	(28.93)	(21.41)	(19.94)	(23.39)	(22.22)	(20.29)
N	711	607	505	478	504	479	483	475	453

Note: The table shows results for ordinary least sqaures regressions controlling for the sampling location and applying robust standard errors. t statistics in parentheses; * $p<0.05$; ** $p < 0.01$; *** $p < 0.001$;
Source: Own calculations based on briq Family Panel waves 1 - 8.

Table C.10: Differential treatment effects for the internal dimension by initial LoC and gender

	Internal Dimension															
	Wave 1		**Wave 2**		**Wave 3**		**Wave 4**		**Wave 5**		**Wave 6**		**Wave 7**		**Wave 8**	
	(Initial Loc)	(Sex)	(Initial LoC)	(Sex)	(Initial Loc)	(Sex)	(Initial LoC)	(Sex)	(Initial Loc)	(Sex)	(Initial LoC)	(Sex)	(Initial Loc)	(Sex)	(Initial LoC)	(Sex)
Treatment	-0.034	-0.055	0.159	0.200	0.032	-0.238	-0.177	-0.005	-0.354	-0.109	-0.058	0.108	0.025	0.057	0.028	-0.067
	(-0.594)	(-0.282)	(0.864)	(1.079)	(0.168)	(-1.310)	(-0.941)	(-0.031)	(-1.933)	(-0.639)	(-0.343)	(0.769)	(0.260)	(0.583)	(0.249)	(-0.616)
High SES	0.125	-0.130	-0.196	-0.216	-0.143	0.042	-0.184	-0.153	0.047	0.017	-0.286	-0.150	0.144	0.076	-0.087	-0.007
	(1.634)	(-0.576)	(-0.882)	(-1.034)	(-0.658)	(0.212)	(-1.002)	(-0.808)	(0.297)	(0.098)	(-1.195)	(-0.800)	(1.359)	(0.817)	(-0.787)	(-0.066)
Initial LoC high	2.813***		0.463**		-0.205		-0.049		-0.212		0.123		0.011		0.018	
	(38.545)		(2.989)		(-1.371)		(-0.344)		(-1.534)		(0.978)		(0.133)		(0.198)	
Treatment x Initial	0.037		-0.125		-0.196		0.163		0.218		-0.080		0.045		-0.002	
	(0.302)		(-0.492)		(-0.766)		(0.681)		(0.888)		(-0.357)		(0.329)		(-0.012)	
Female		0.348*		0.401**		-0.360*		-0.077		0.237		-0.168		-0.190*		-0.167
		(2.142)		(2.599)		(-2.452)		(-0.542)		(1.711)		(-1.347)		(-2.278)		(-1.839)
Treatment x Female		-0.216		-0.262		0.375		-0.179		-0.251		-0.461*		-0.036		0.196
		(-0.791)		(-1.035)		(1.486)		(-0.776)		(-1.025)		(-2.167)		(-0.266)		(1.305)
Constant	1.252***	2.836***	2.834***	2.934***	2.887***	2.916***	6.108***	6.122***	6.123***	5.885***	5.569***	5.716***	3.973***	4.079***	4.070***	4.165***
	(19.584)	(17.592)	(18.509)	(19.160)	(20.313)	(21.654)	(42.233)	(46.568)	(46.001)	(43.614)	(48.011)	(53.288)	(52.431)	(53.187)	(46.483)	(48.835)
r2	0.789	0.020	0.031	0.023	0.013	0.019	0.005	0.008	0.018	0.018	0.014	0.048	0.013	0.032	0.009	0.010
N	712	712	607	607	508	508	504	504	479	479	479	479	469	469	456	456

Note: The tables shows the results for ordinary least squares estimations of internal locus of control with and without interaction terms for initial locus of control and gender. City dummies were used as control variables and robust standard errors applied. t statistics in parentheses;
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Own calculations based on briq Family Panel waves 1 - 8.

Table C.11: Differential treatment effects for the powerful others dimension by initial LoC and gender

	Powerful Others							
	Wave 1		**Wave 2**		**Wave 3**		**Wave 6**	
	(Initial Loc)	(Sex)	(Initial LoC)	((Sex))	(Initial Loc)	(Sex)	(Initial LoC)	(Sex)
Treatment	-0.095	-0.282*	0.084	-0.011	-0.168	-0.175	0.215	0.061
	(-0.748)	(-2.159)	(0.706)	(-0.094)	(-1.461)	(-1.598)	(1.084)	(0.343)
High SES	-0.073	-0.175	-0.040	-0.157	-0.082	-0.191	-0.183	-0.098
	(-0.538)	(-1.305)	(-0.275)	(-1.117)	(-0.605)	(-1.548)	(-0.996)	(-0.560)
Initial LoC high	0.118		0.182		-0.090		-0.026	
	(1.197)		(1.778)		(-0.962)		(-0.171)	
Treatment x Initial	-0.130		-0.033		0.029		-0.285	
	(-0.736)		(-0.202)		(0.187)		(-1.102)	
Female		0.060		-0.025		-0.150		0.022
		(0.616)		(-0.238)		(-1.634)		(0.147)
Treatment x Female		0.256		0.150		0.052		-0.008
		(1.476)		(0.906)		(0.344)		(-0.030)
Constant	3.670***	3.705***	3.503***	3.632***	3.206***	3.220***	3.322***	3.287***
	(36.549)	(35.795)	(38.250)	(38.254)	(36.874)	(37.111)	(24.276)	(23.362)
r2	0.019	0.025	0.012	0.007	0.017	0.019	0.009	0.003
N	711	711	607	607	505	505	478	478

Note: The tables shows the results for ordinary least squares estimations of powerful others locus of control with and without interaction terms for initial locus of control and gender. City dummies were used as control variables and robust standard errors applied. t statistics in parentheses;
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Own calculations based on briq Family Panel waves 1 - 8.

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